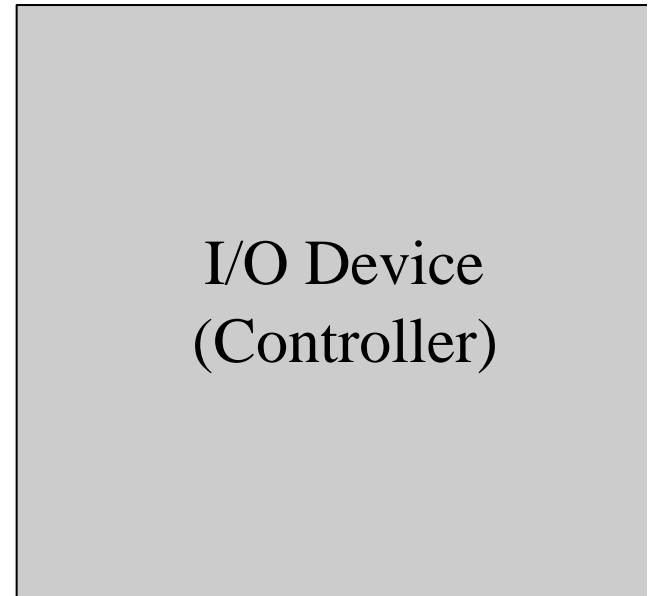
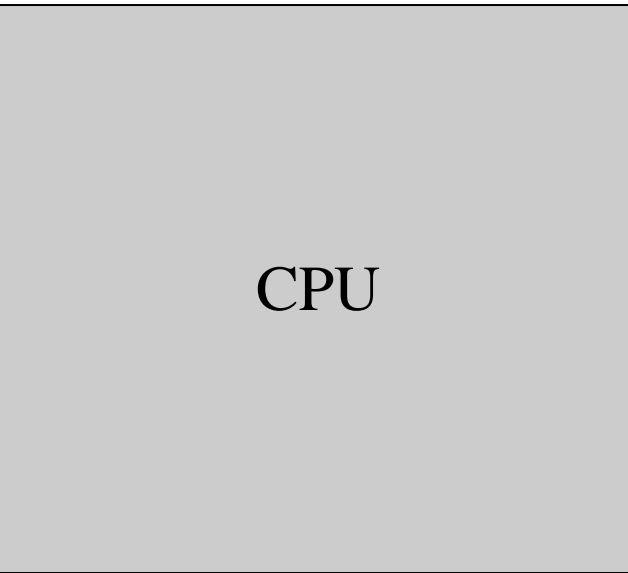


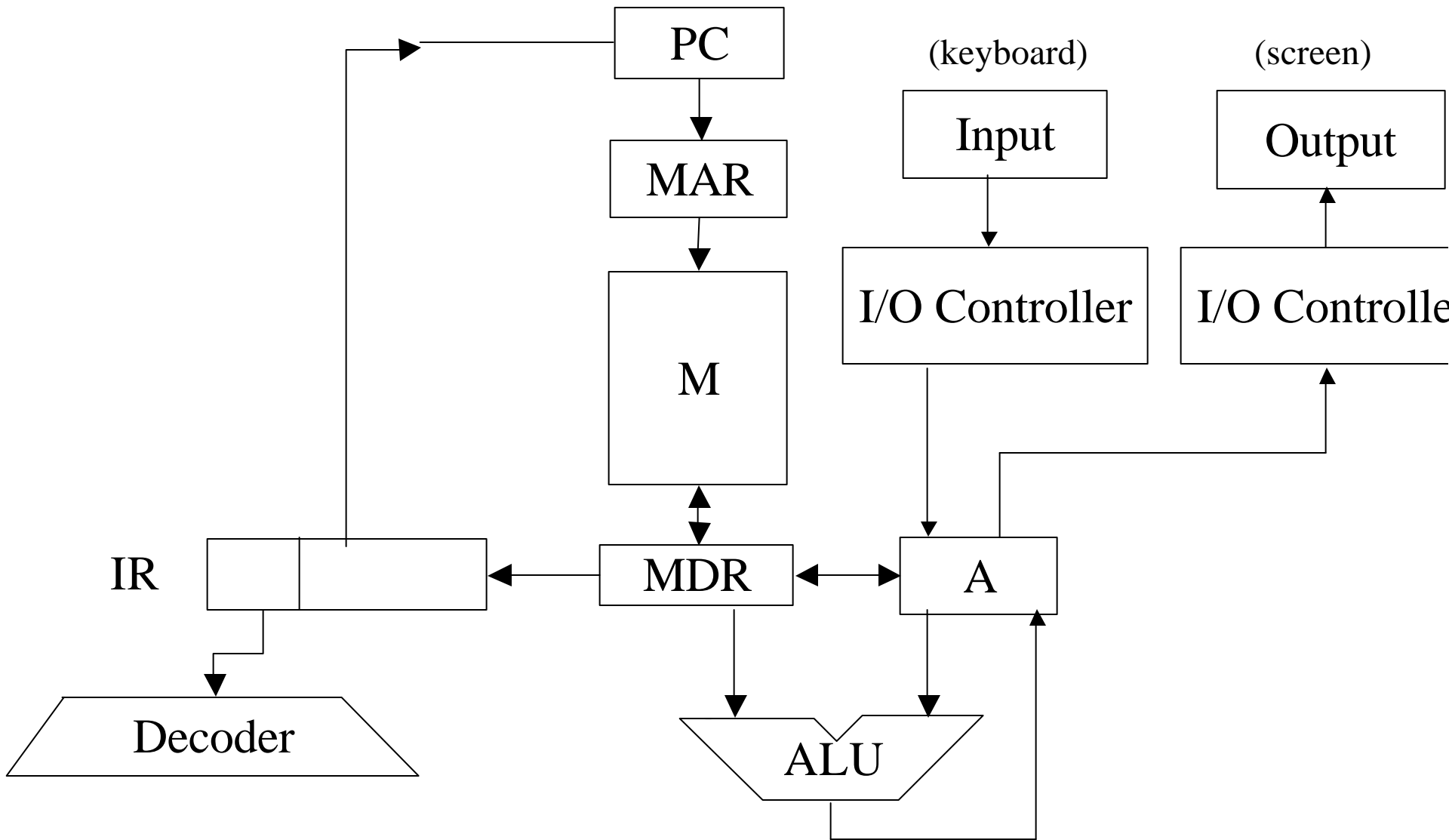
# CDA 4150 Notes for March 24<sup>th</sup>

Rishan Chandarana  
Greg Meno

I/O



# VN Machine



# Instructions

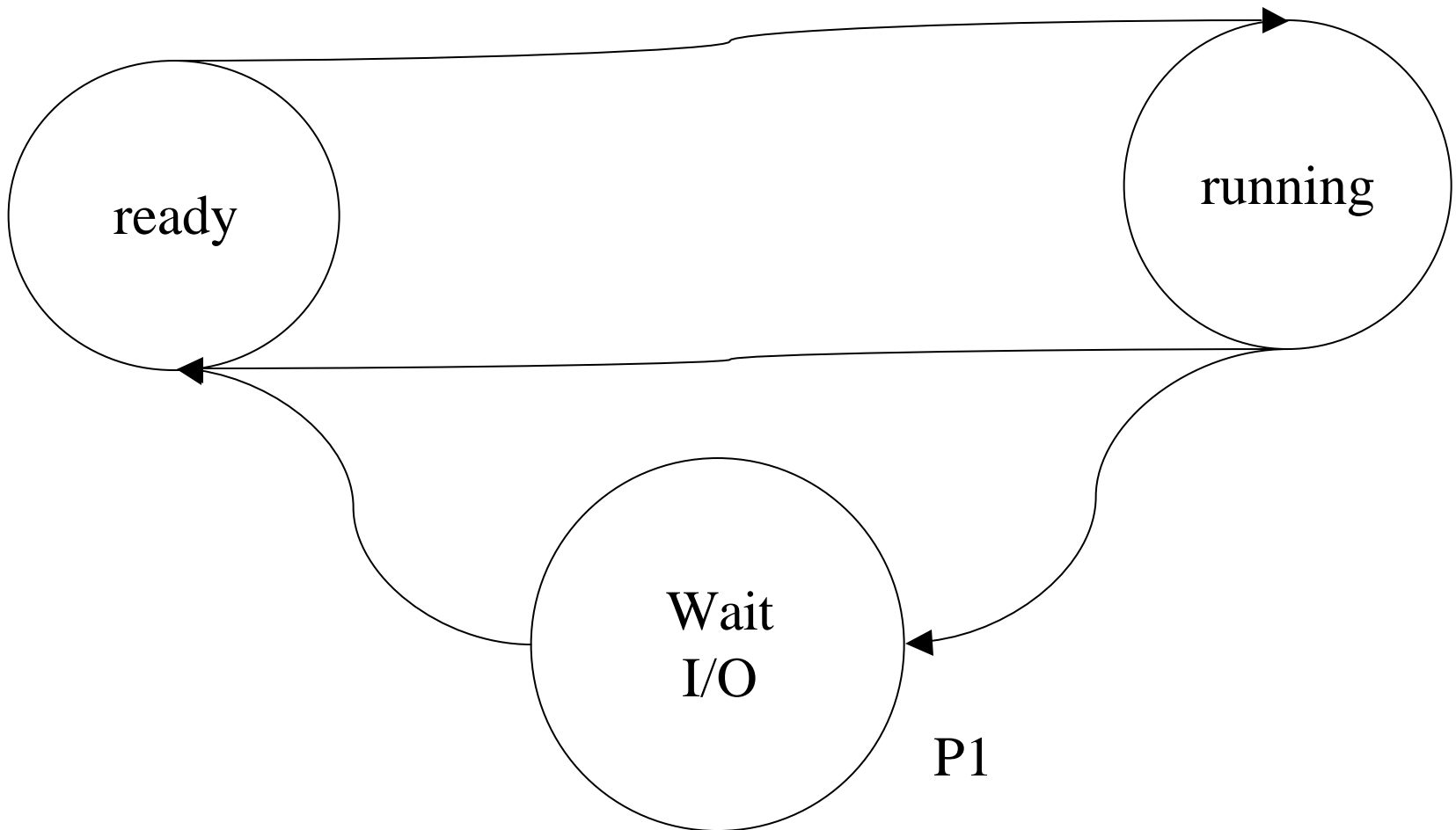
IN <DEVICE>  
OUT <DEVICE>

Example:

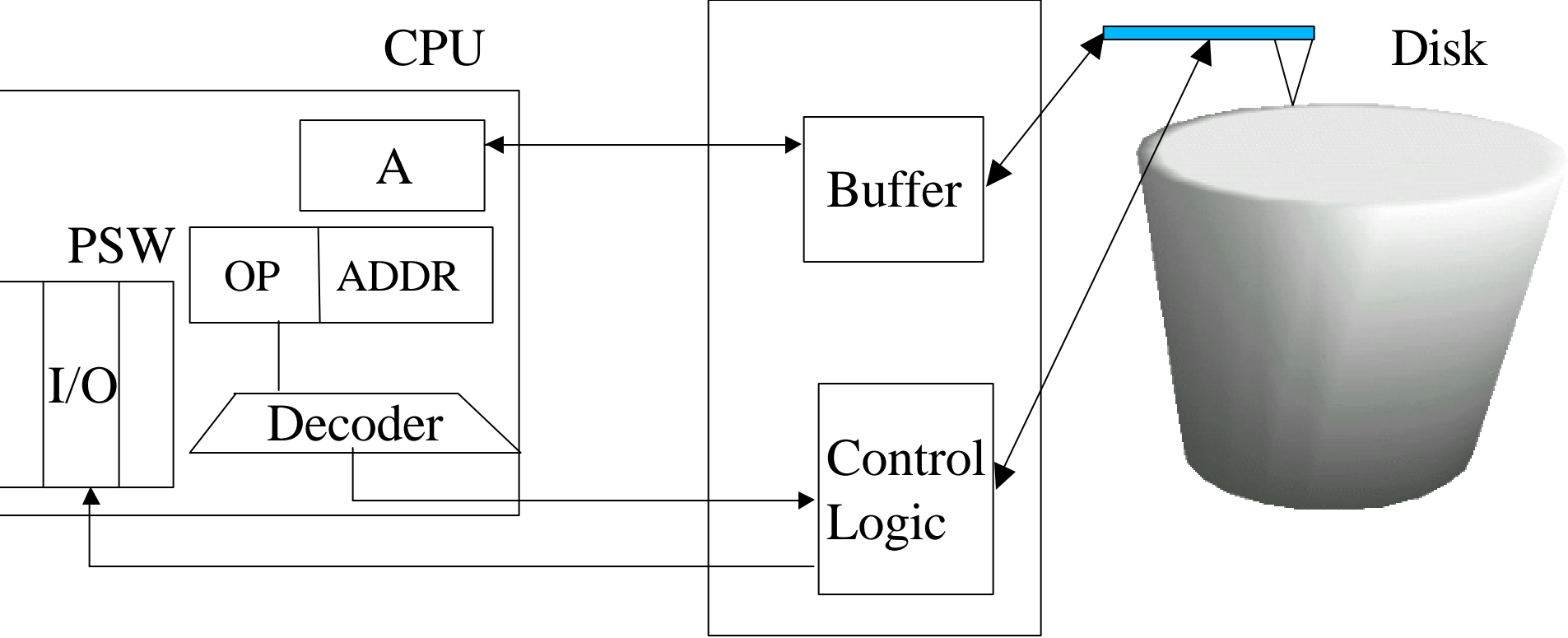
IN <KEYBOARD>  
OUT <SCREEN>

# CPU

The CPU is idle during I/O.  
Process P1 is waiting on I/O.

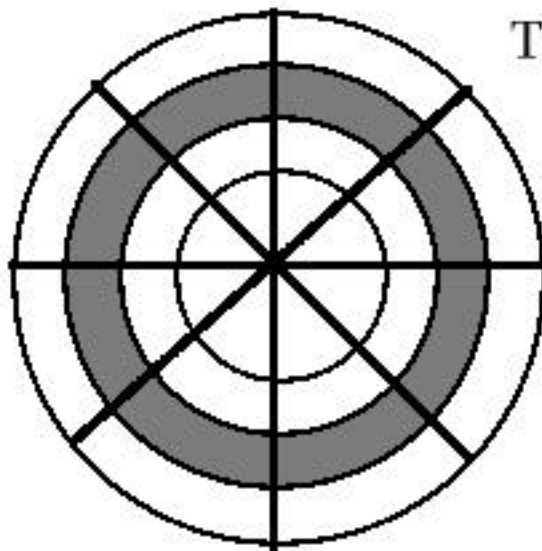


# Layout of Drive, Controller and CPU

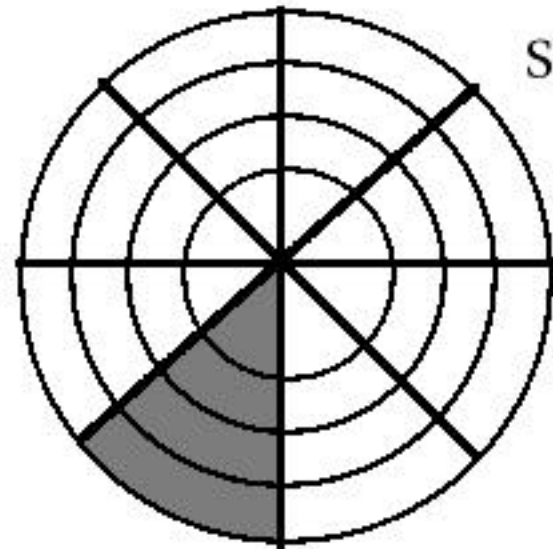


# Disk Layout

When Moving from track to track on the disk we encounter a delay called "seek time".



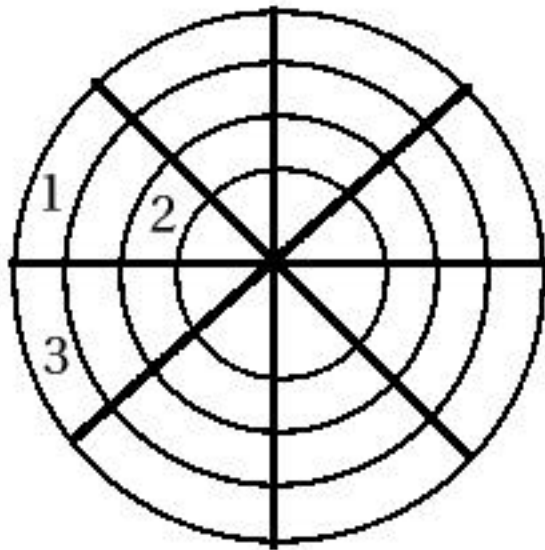
Track



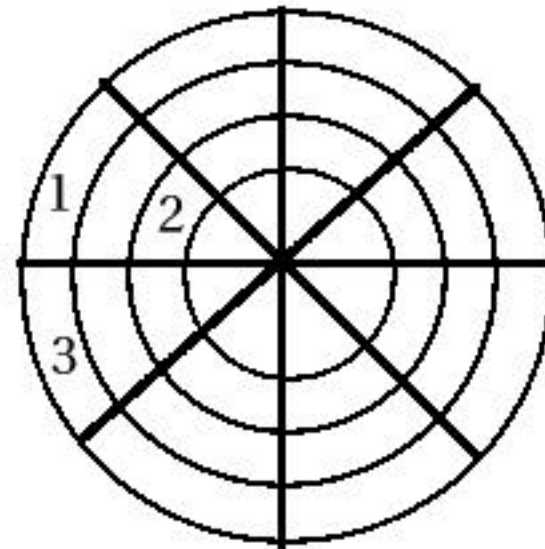
Sector

# I/O Optimization

We can minimize the effect of seek time by reordering the I/O requests.



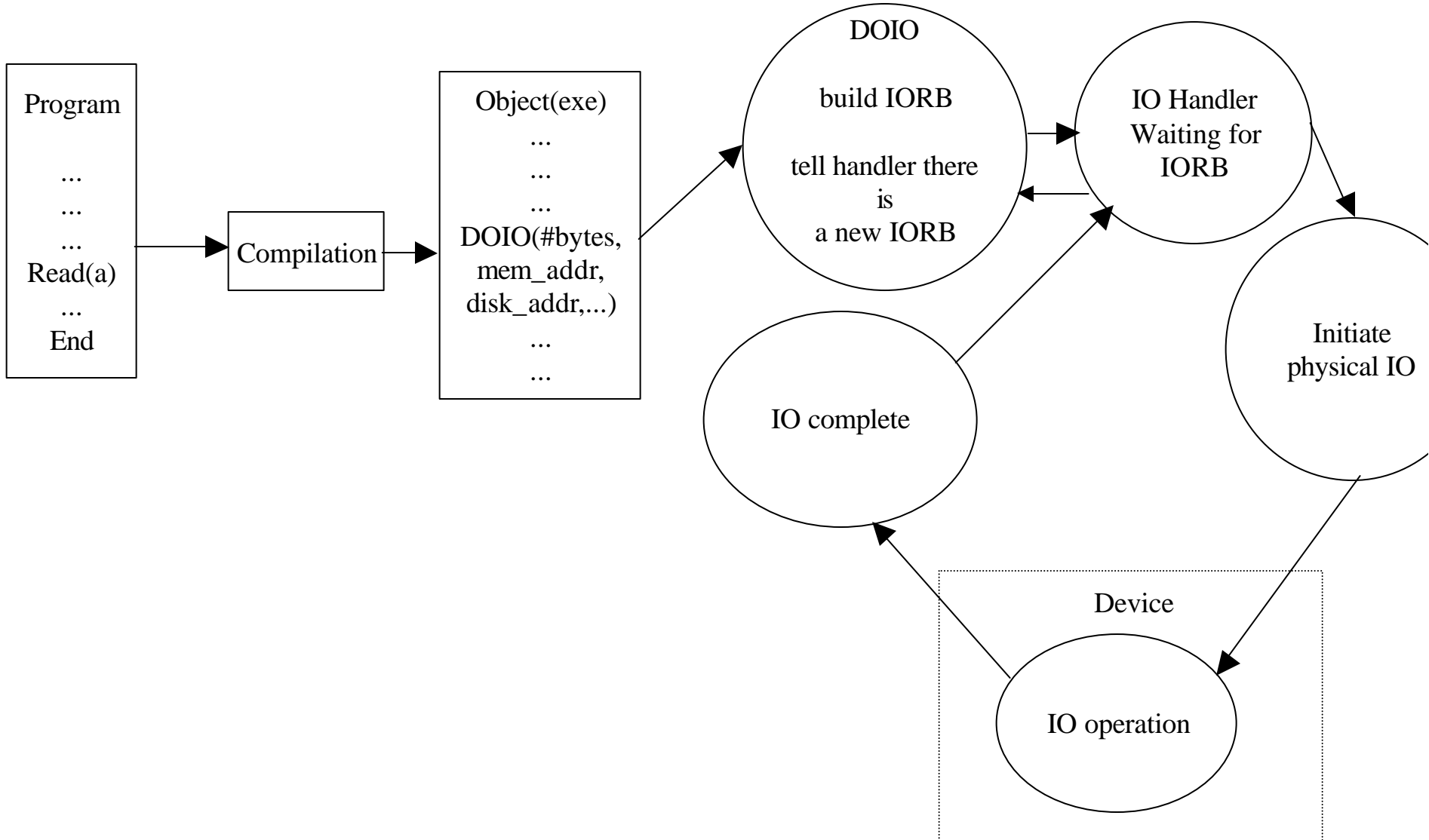
IO 1  
seek  
IO 2  
seek



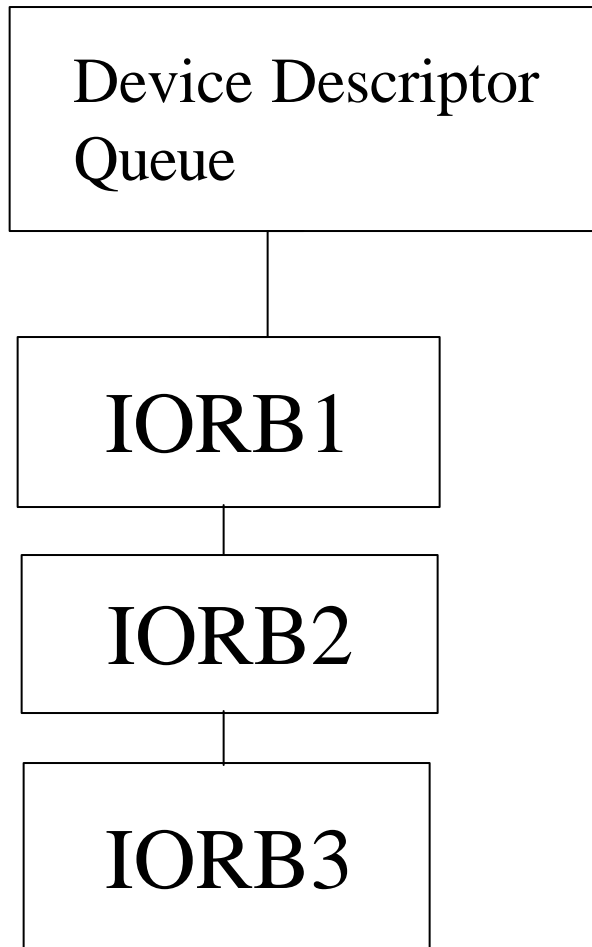
IO 1  
IO 3  
seek



# I/O operations from program to hardware

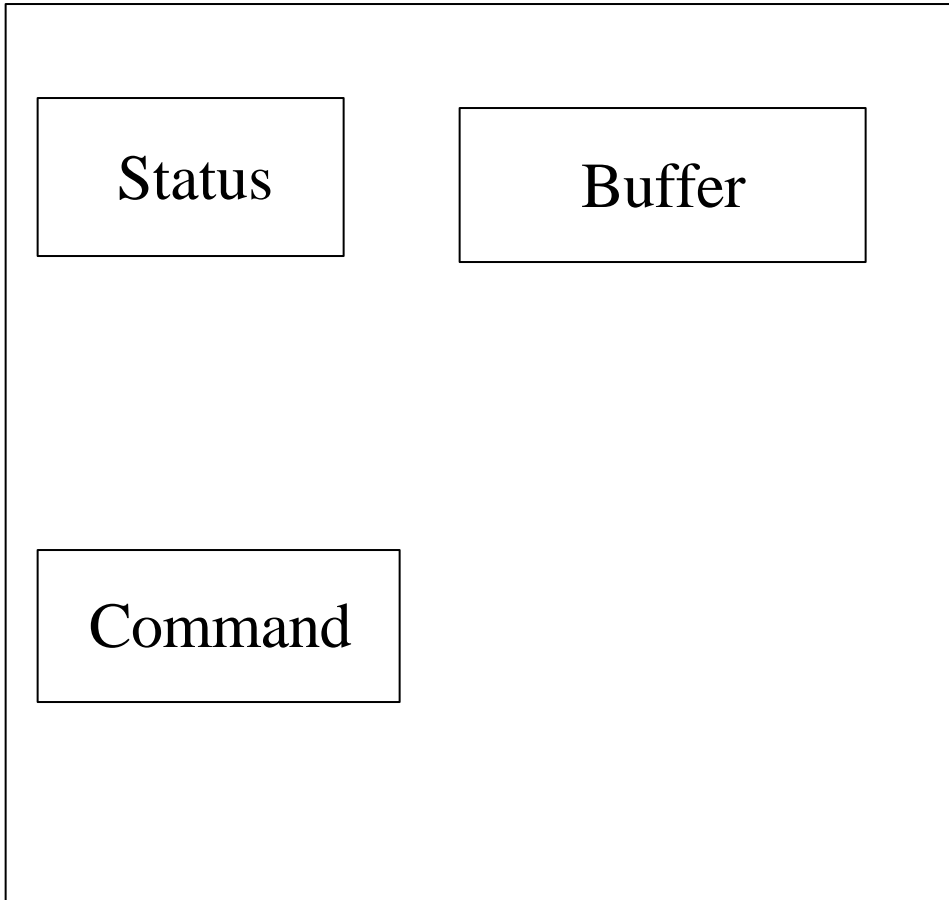


# Device descriptor and IORB queue



The I/O handler is used to reorder this queue because it knows more information about the physical characteristics of the I/O device than does to `DOIO()` OS routine

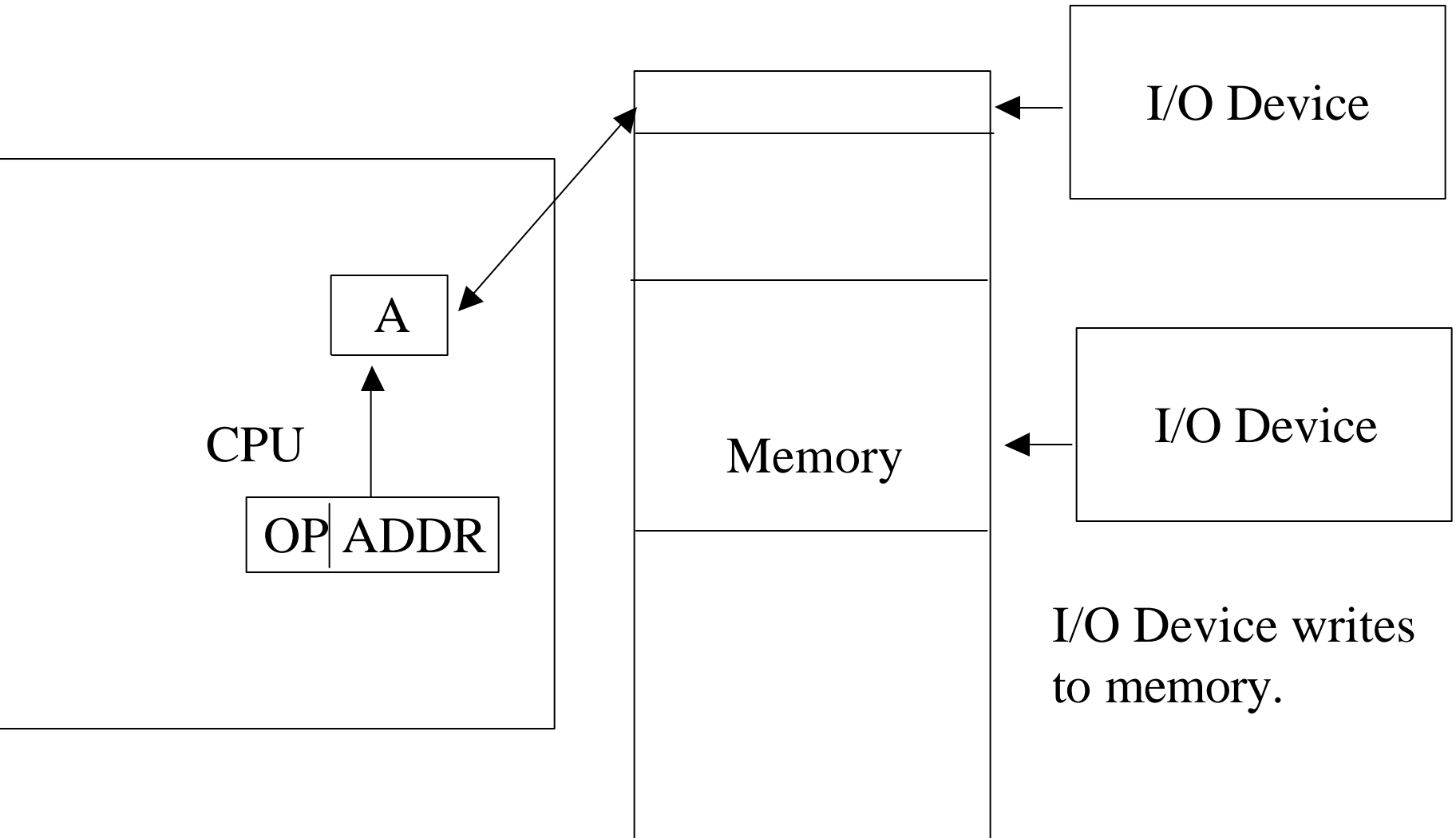
# I/O Device



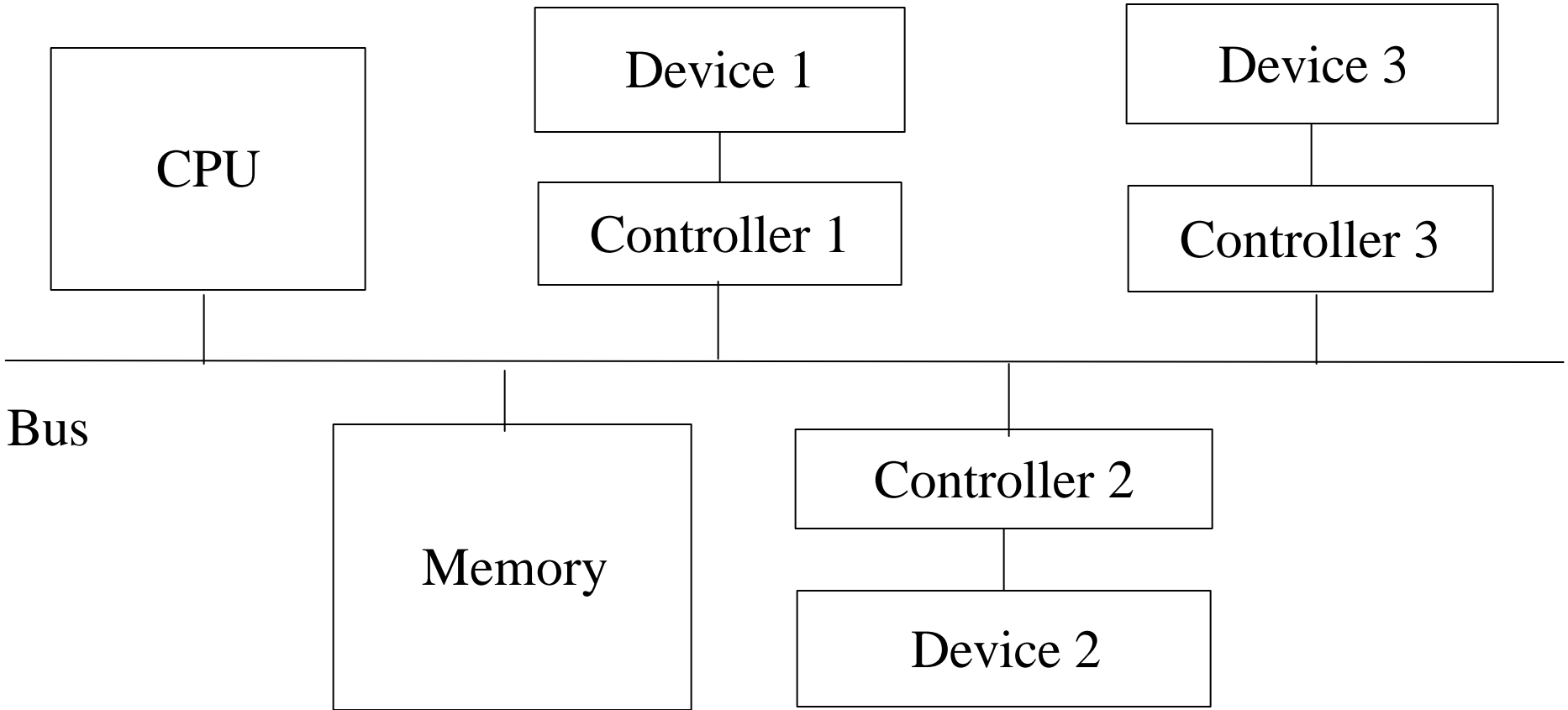
Status: Tests to see if device is busy.

Buffer has to be large for DMA (Direct Memory Access).

# Memory as Buffer



# Bus Layout



\*Each device has its own characteristics. (Ex. Seek Time)