

# I/O Management and Disk Scheduling

Ref: Stallings

# Contents

- I/O Devices
- Organization of the I/O Function
- Operating System Design Issues
- I/O Buffering
- Disk Scheduling
- RAID
- Disk Cache

# I/O Devices

- External devices can be categorized into
  - Human readable:- Eg. Printers, visual display terminals, keyboards, mouse
  - Machine readable:- Eg: disk and tape drives, sensors, actuators
  - Communications:-Modems

I

Differences exist among these classes

# Differences

- Data rates: data transfer rates range from  $10^1$  to  $10^9$
- Applications: how the device is used has an influence on the software and policies in the OS and supporting utilities
- Complexity of control: depends on the device.  
Printer –simple control when compared to a disk
- Unit of transfer: as bytes or characters
- Data representation: different data encoding schemes
- Error conditions: different from device to device

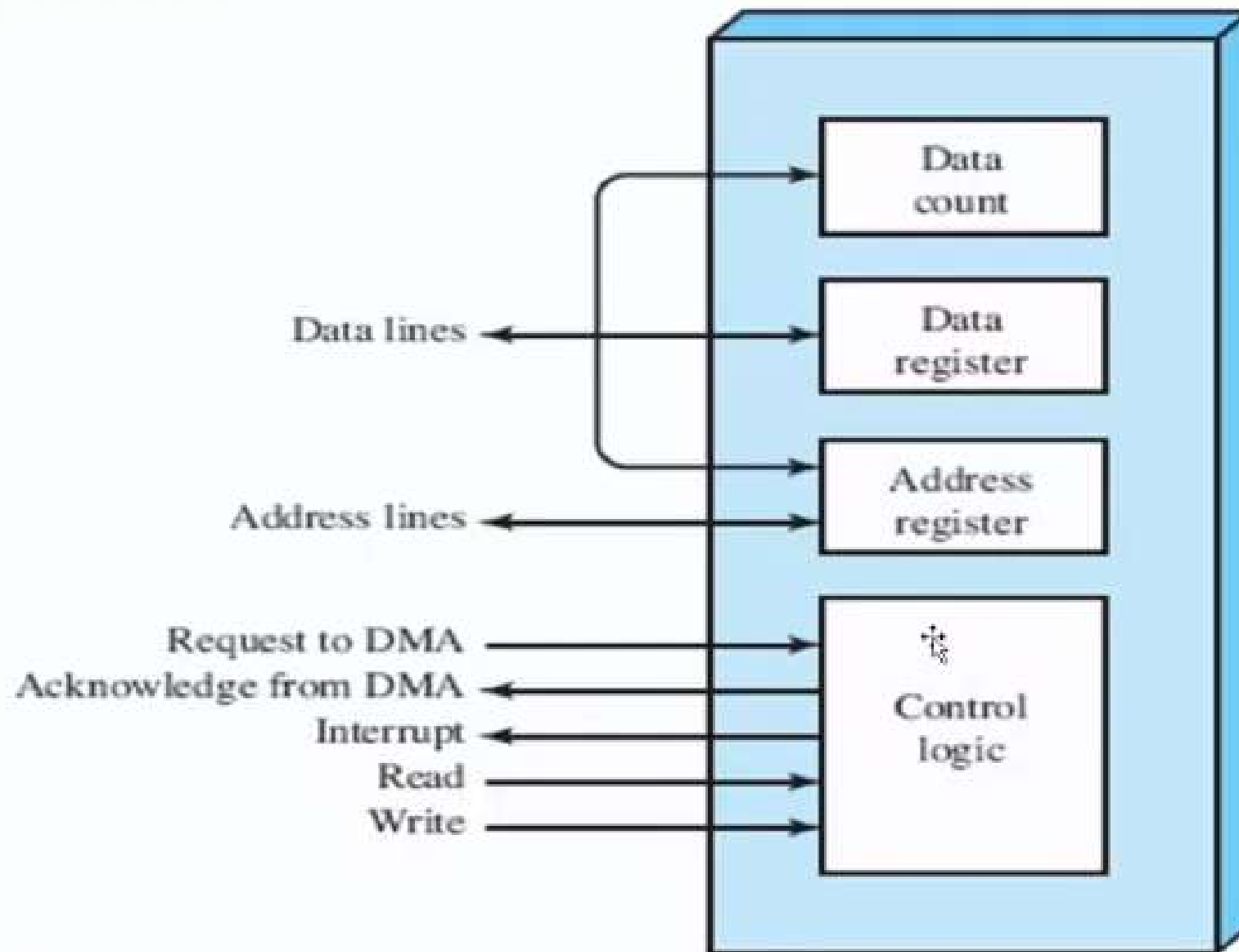
# Organization of the I/O function

- Programmed I/O :
  - Processor issues an I/O command on behalf of the process to an I/O module
  - Process then busy waits for the operation to be completed
- Interrupt-Driven I/O
  - Processor issues an I/O command on behalf of the process to an I/O module
  - Continues to execute instructions
  - Interrupted by I/O when the latter has completed its work
- Direct Memory Access
  - Controls the exchange of data between main memory and an I/O module.
  - Processor sends a request for the transfer of a block of data to DMA
  - Interrupted only after the entire block has been transferred

# Evolution of the I/o Function

- The processor directly controls a peripheral device
- A controller or I/O module is added and processor uses programmed I/O without interrupts
- I/O module with interrupts
- The I/O module is given direct control of memory via DMA.
- I/O module is enhanced to I/O processor; CPU directs the I/O processor to execute an I/O program in main memory
- I/O module has a local memory of its own. With this architecture, a large set of I/O devices can be controlled

# Direct Memory Access



# Direct memory Access

- When processor wishes to read/write a block of data, issues command to the DMA module
  - Read/Write using the read/write control line between processor and DMA module
  - The address of the I/O device involved using data lines
  - The starting location in memory to read from or write to, communicated on the data lines and stored by the DMA module in its address register
  - The number of words to be read/written, communicated via the data lines and stored in the data count register

After transfer of block of data is accomplished the DMA module sends a interrupts signal to the processor