CSc 360
Operating Systems
I/O Systems

Jianping Pan

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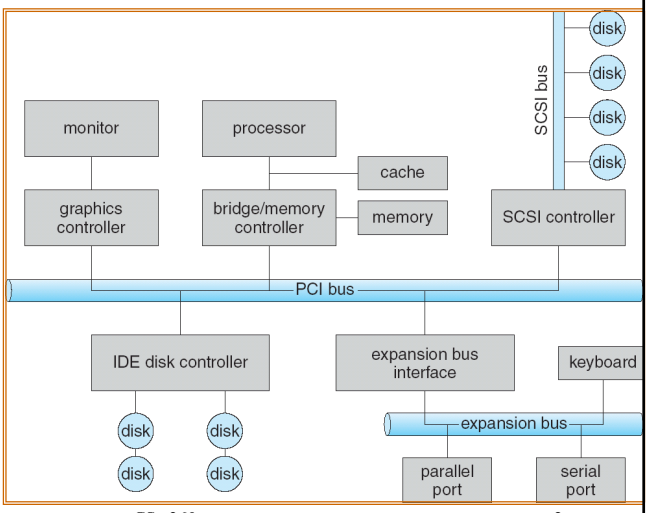
I/O structure

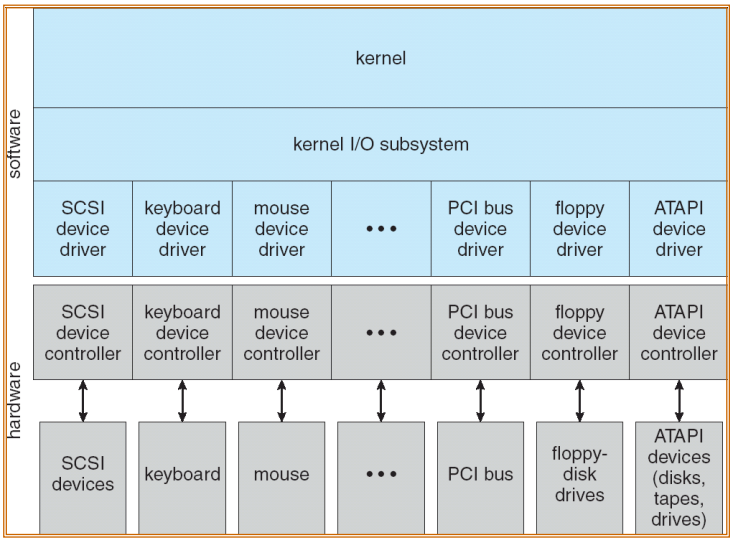
- I/O access
  - port number
  - interrupt #
  - DMA number
- E.g.,
  - PC



I/O access

- Polling: busy, ready, error
  - "busy-wait"
- Interrupt: event-driven
  - asynchronous operation
  - interrupt controller
- DMA: bulk transfer
  - high-speed I/O
  - DMA controller

Kernel I/O structure



I/O characteristics

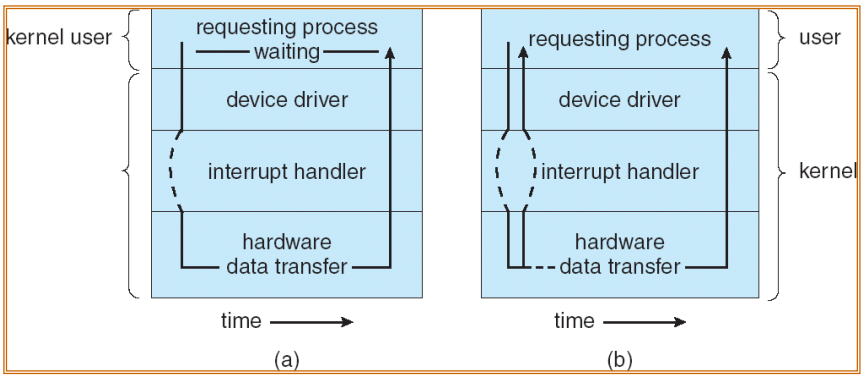
aspect	variation	example
data-transfer mode	character block	terminal disk
access method	sequential random	modem CD-ROM
transfer schedule	synchronous asynchronous	tape keyboard
sharing	dedicated sharable	tape keyboard
device speed	latency seek time transfer rate delay between operations	
I/O direction	read only write only read–write	CD-ROM graphics controller disk

Common devices

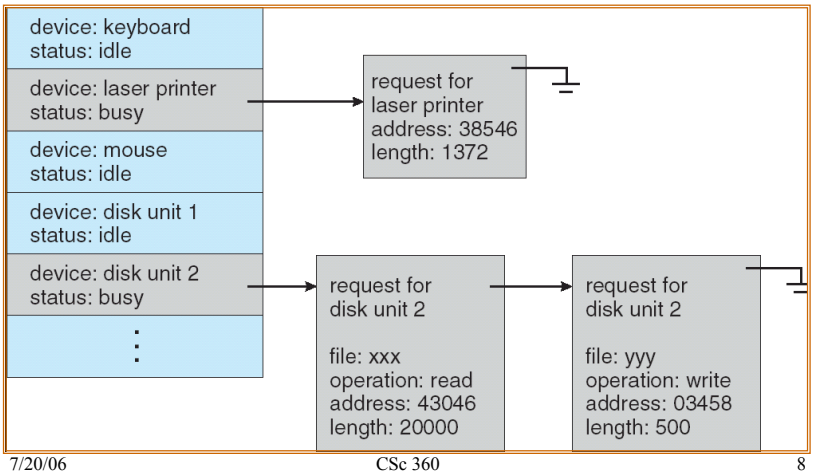
- Block device
  - e.g., disk drive
  - random access: read, write, seek
- Character device
  - e.g., keyboard, serial port
  - sequential access: getc, putc
- Network device
  - e.g., socket

Asynchronous I/O

- Also, blocking vs non-blocking I/O



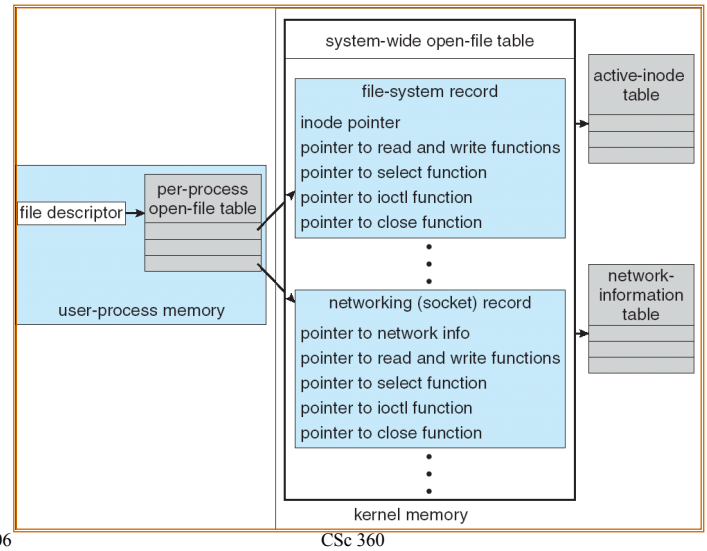
I/O scheduling



More on I/O systems

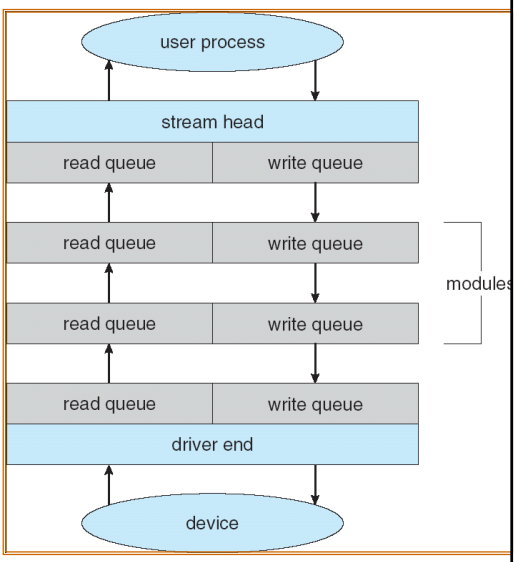
- Caching
  - I/O is relatively slow
- Spooling
  - one job at a time
- Reservation
  - be aware of deadlock
- Error handling
- Protection: I/O access is privileged

Unix I/O structure



STREAMS structure

- Full-duplex
  - btw dev and usr
- Unix Sys V
- Stream head
- Modules
  - read/write queue
- Driver end



This lecture

- I/O systems
  - I/O structures
  - I/O devices
    - block, character, network, etc
  - I/O access
    - polling, interrupt, DMA
- Again, the main focus of this course
  - process, memory, storage management!