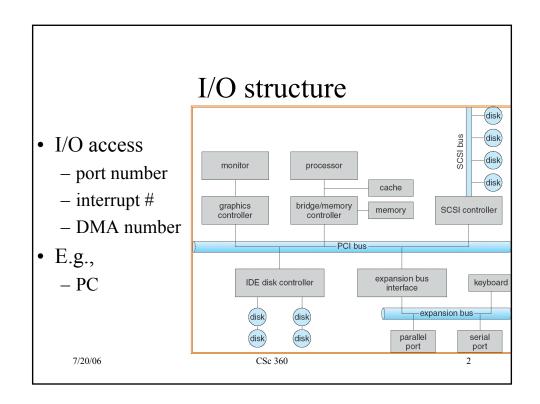
CSc 360 Operating Systems I/O Systems

Jianping Pan Summer 2006

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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

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Kernel I/O structure kernel software kernel I/O subsystem SCSI keyboard PCI bus ATAPI mouse floppy device device device device device device driver driver driver driver driver driver SCSI keyboard PCI bus ATAPI mouse floppy device controller device controller device controller device controller device controller device controller hardware ATAPI floppydevices SCSI PCI bus keyboard mouse disk (disks, devices drives tapes, drives) 7/20/06 CSc 360

I/O characteristics

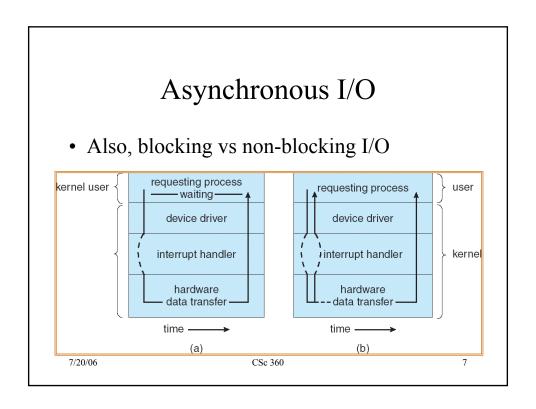
aspect	variation	example
data-transfer mode	character block	terminal disk
access method	sequential random	modem CD-ROM
transfer schedule	synchronous asynchronous	tape keyboard
sharing	dedicated sharable	tape keyboard
device speed	latency seek time transfer rate delay between operations	
I/O direction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

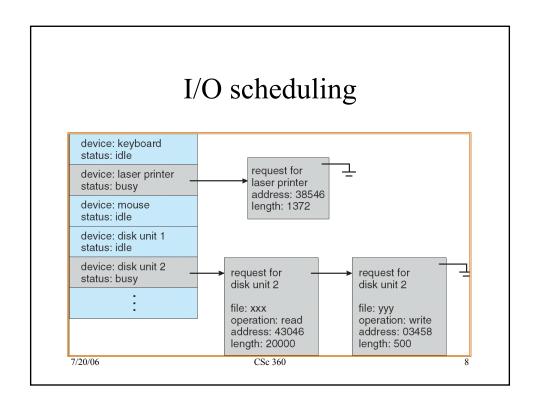
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Common devices

- 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

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More on I/O systems

- Caching
 - I/O is relatively slow
- Spooling
 - one job at a time
- Reservation
 - be aware of deadlock
- Error handling
- \bullet Protection: I/O access is privileged $_{^{7/20/06}}$

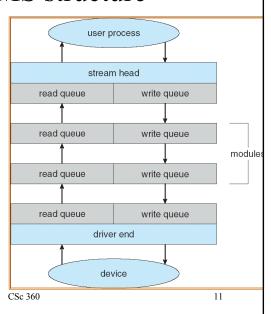
Unix I/O structure system-wide open-file table active-inode file-system record table inode pointer pointer to read and write functions pointer to select function per-process open-file table pointer to ioctl function file descriptor pointer to close function networkinformation networking (socket) record user-process memory table pointer to network info pointer to read and write functions pointer to select function pointer to ioctl function pointer to close function kernel memory 7/20/06 CSc 360 10

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STREAMS structure

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

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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!

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