CS 422/522 Design & Implementation
of Operating Systems

Lecture 18: Midterm Review

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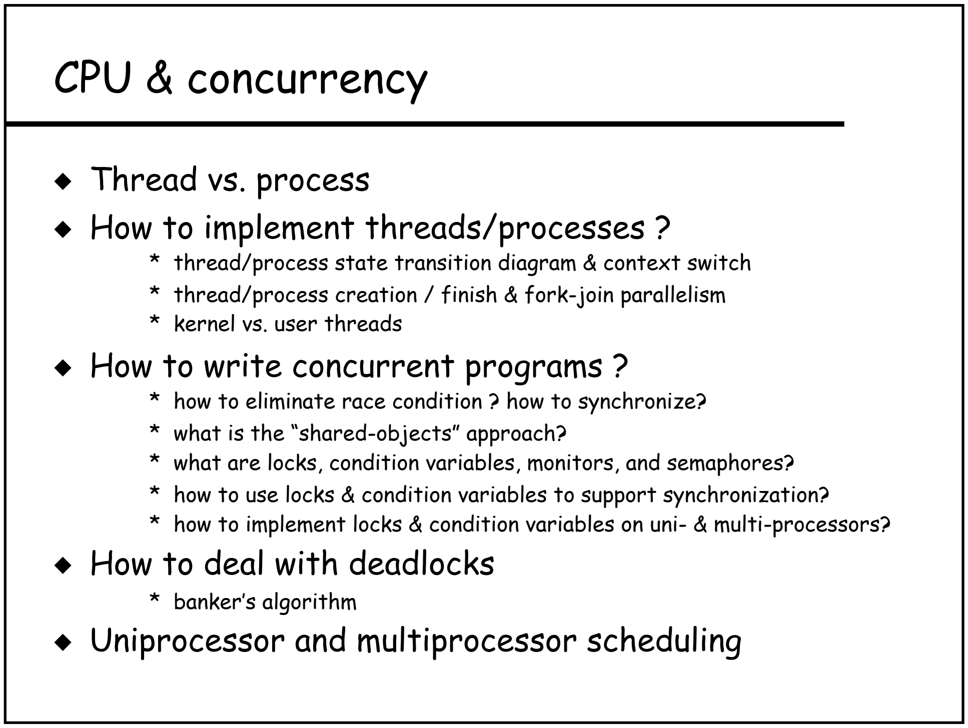
The big picture

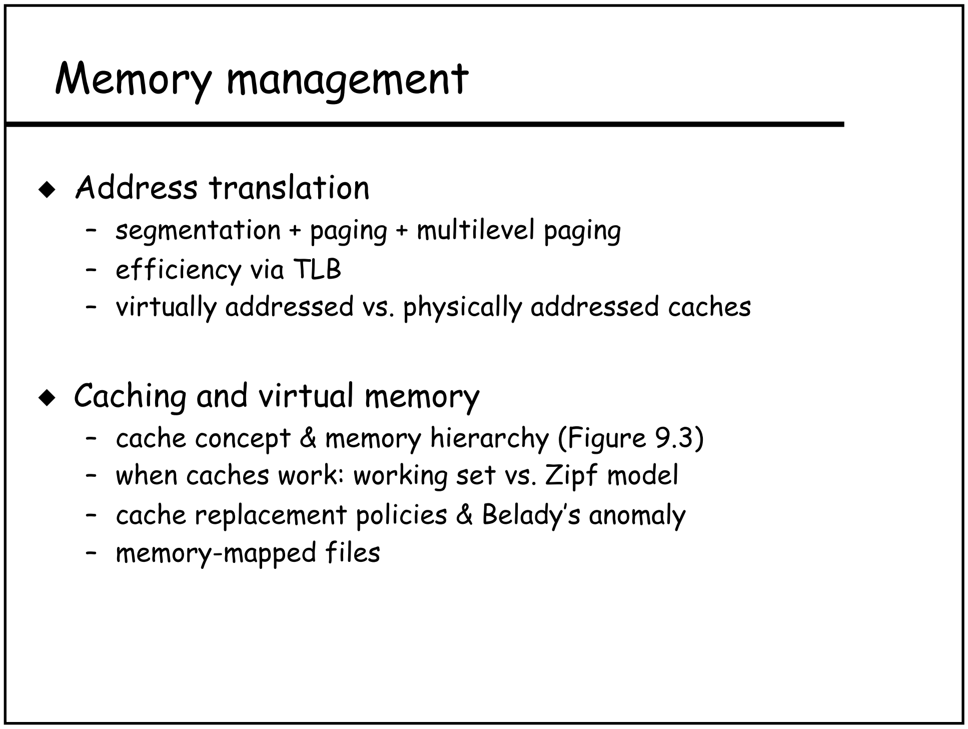
- OS roles: referee, illusionist, and glue (AD 1.1)
- Kernel and process abstraction (AD 2.1-2.4, 3.1-3.5)
  - Why process abstraction?
  - Dual-mode operation (privileged instructions; timer interrupts; memory protection)
  - Safe control transfer
  - Interrupts vs. exceptions vs. system calls
- CPU & concurrency (AD 4.1-4.8, 5.1-5.8, 6.5, 7.1-7.2)
- Memory management (AD 8.1-8.3, 9.1-9.6)
- I/O devices (AD 11, 12, 13, 14)
- Security & Trust (only the first 7 slides of L18.pdf)



CPU & concurrency

- Thread vs. process
- How to implement threads/processes ?
  - thread/process state transition diagram & context switch
  - thread/process creation / finish & fork-join parallelism
  - kernel vs. user threads
- How to write concurrent programs ?
  - how to eliminate race condition ? how to synchronize?
  - what is the "shared-objects" approach?
  - what are locks, condition variables, monitors, and semaphores?
  - how to use locks & condition variables to support synchronization?
  - how to implement locks & condition variables on uni- & multi-processors?
- How to deal with deadlocks
  - banker's algorithm
- Uniprocessor and multiprocessor scheduling

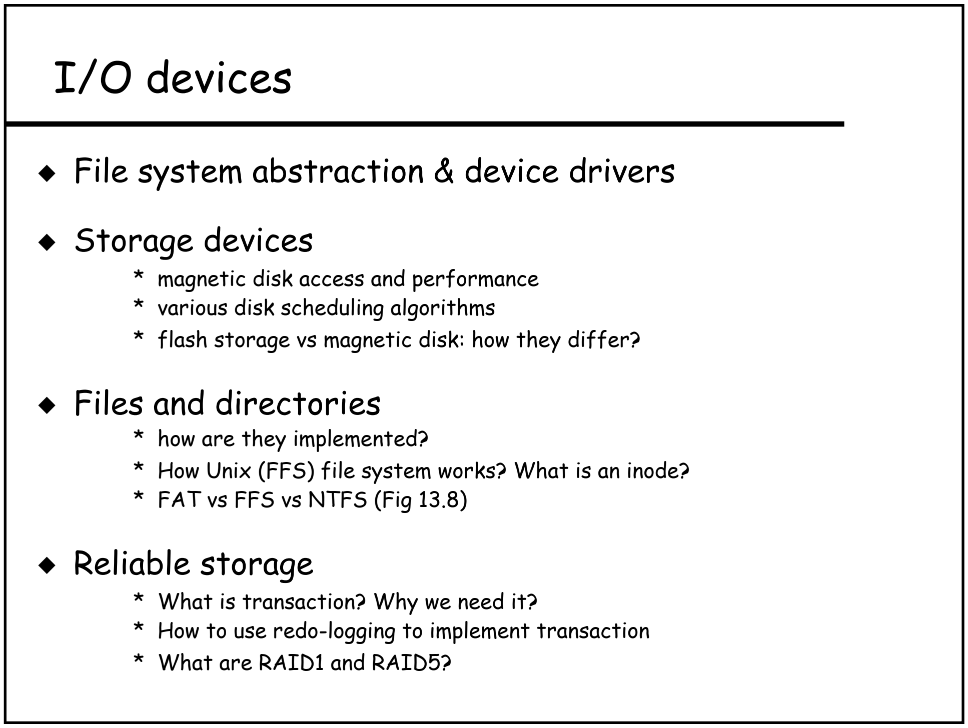
3



Memory management

- Address translation
  - segmentation + paging + multilevel paging
  - efficiency via TLB
  - virtually addressed vs. physically addressed caches
- Caching and virtual memory
  - cache concept & memory hierarchy (Figure 9.3)
  - when caches work: working set vs. Zipf model
  - cache replacement policies & Belady's anomaly
  - memory-mapped files

4



I/O devices

- File system abstraction & device drivers
- Storage devices
    - * magnetic disk access and performance
    - * various disk scheduling algorithms
    - * flash storage vs magnetic disk: how they differ?
- Files and directories
    - * how are they implemented?
    - * How Unix (FFS) file system works? What is an inode?
    - * FAT vs FFS vs NTFS (Fig 13.8)
- Reliable storage
    - * What is transaction? Why we need it?
    - * How to use redo-logging to implement transaction
    - * What are RAID1 and RAID5?