

# Course Wrapup

# Major Topics

- Protection
  - Kernel/user mode, system calls
- Concurrency
  - Threads, monitors, deadlock, scheduling
- Memory management
  - Address translation, demand paging
- File systems
  - Disk, flash, file layout, transactions

# OS as Referee

- Protection
  - OS isolates apps from bugs or attacks in other apps
  - Pipes and files for interprocess communication
- CPU scheduling
  - OS decides which application thread is next onto the processor
- Memory allocation
  - OS decides how many memory frames given to each app
- File system
  - OS enforces security policy in accessing file data

# OS as Illusionist

## *Physical Reality*

Limited # of CPUs

CPU interrupts and time slicing

Limited physical memory

Apps share physical machine

Computers can crash

## *Abstraction*

Can assume near infinite # of processes/threads

Each thread appears to run sequentially (at variable speed)

Near-infinite virtual memory

Execution on virtual machine with isolation between apps

Changes to file system are atomic and durable

# OS as Glue

- Locks and condition variables
  - Not test&set instructions
- Named files and directories
  - Not raw disk block storage
- Pipes: stream interprocess communication
  - Not fixed size read/write calls
- Memory-mapped files
  - Not raw disk reads/writes

# OS Trends and Future Directions

- Optimize for the computer's time
  - => optimize for the user's time
- One processor => many
- One computer => server clusters
- Disk => solid state memory
- Operating systems at user level
  - Browsers, databases, servers, parallel runtimes

# Advertisements

- CSE 452: Distributed Systems
  - How can we build scalable systems that work even though parts of the system can fail at any time?
- CSE 484: Security
  - How can we build systems that can withstand attack?
- CSE 444: Databases
  - How do we build systems that can manage giant amounts of data reliably and efficiently?
- CSE 461: Networks
  - How do we build protocols to allow reliable and efficient communication between computers?