Midterm Review

Topic List:

- **Kernel**
  - Kernel/User Separation
  - Privilege Mode
  - System Calls
  - Monolithic vs Microkernels
- **Memory Management**
  - Fragmentation
  - Segmentation
  - Virtual Memory
  - Locality
  - Paging
    - Multi-Level Page Tables
    - Page Replacement
- **Processes**
  - Process State
  - Process Transitions
    - Interrupts, Traps, Exceptions
  - PCB
- **Threads**
  - Kernel vs User Threads
  - Concurrency and Parallelism
  - TCB

Synchronization

x86 Hardware Provided Timer Interrupts:

`int splx(LOW)`

Turns interrupts on. Returns old interrupt value.

`int splx(HIGH)`

Turns interrupts off. Returns old interrupt value.

x86 Hardware Provided Atomic Testing:

`int atomic_test_and_set(lock *l)`

Returns 1 if lock is in use.
Returns 0 if lock is acquired.

`void atomic_clear(lock *l)`

Releases the lock.

Mutex:

`lock(mutex_t lock)` -

Acquire the lock, blocking if necessary.

`unlock(mutex_t lock)` -

Release the lock. Assumed that the calling thread owns the lock

Condition Variables:

`wait(cond_t cv, mutex_t lock)`

Block the calling thread until the condition has been signaled.

Atomically does the following:

1. Releases lock.
2. Add thread to the waiters for cond.
3. Sleeps thread until awoken.

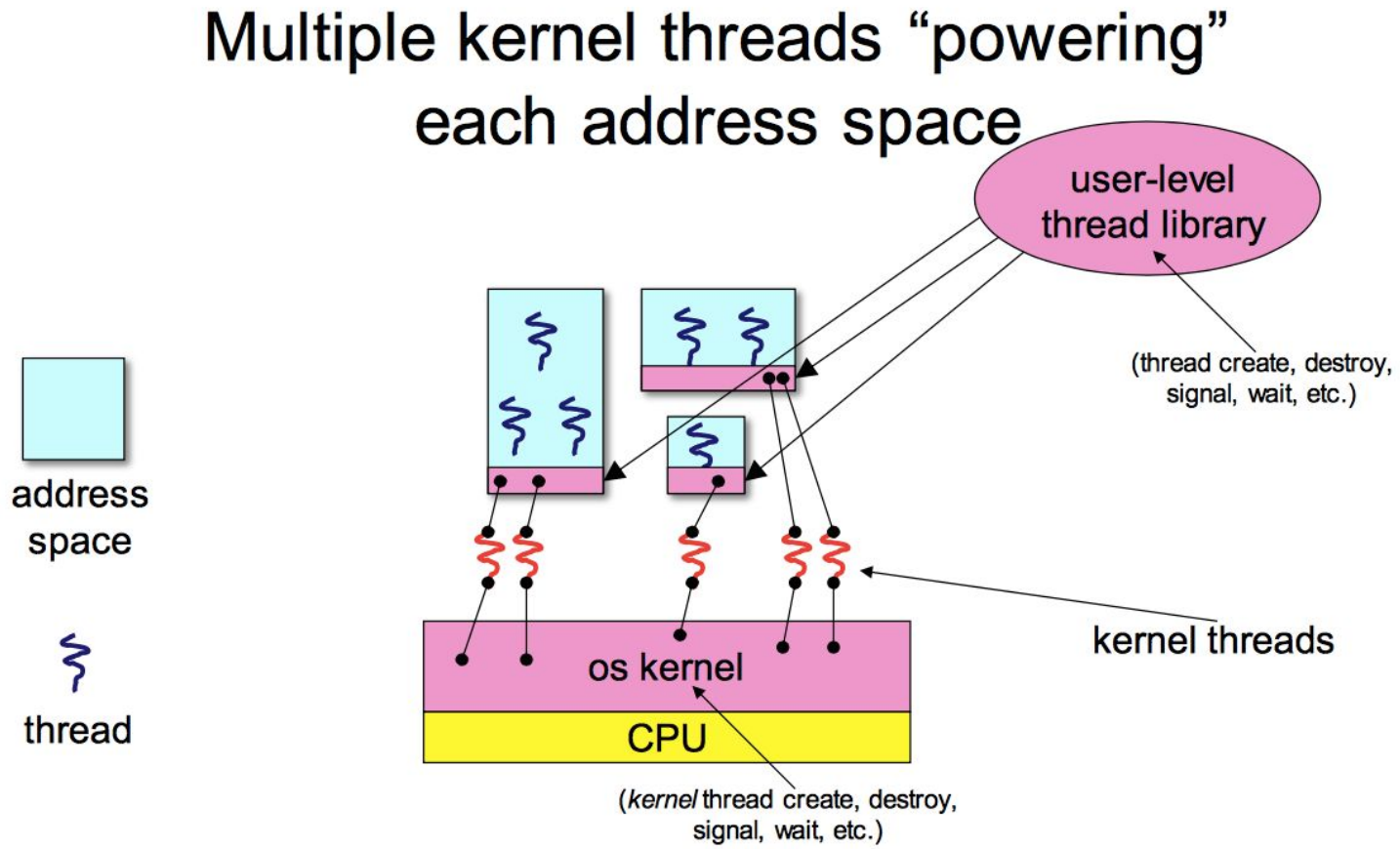
`signal(cond_t cv)`

Signal that the condition has been met, awakening a single waiting thread.

(Though not switching to the newly awoken thread immediately.)

`broadcast(cond_t cv)`

Signal that the condition has been met, awakening all waiting threads.



Kernel Threads: Created and scheduled by the kernel. These are the threads being run on the CPU.
User Threads: Created by a threading library and scheduling is managed in user space.
Much faster to context switch between these as they share address space.

User Thread States + Transitions: