Programming assignment 4

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Lock

• Spin lock
  • While(try_acquire_lock)do_nothing;

• Sleep lock
  • If(cannot_acquire_lock)sleep();
  • Wakeup only when lock is passed to
    • I.e., at release, find 1 thread that is waiting for this lock, and wakeup
  • (Wakeup all waiting threads and let them compete again)
Implementing lock

- Lock data structure <- pthread_mutex_t
  - kern/include/synch.h
- Lock implementation
  - kern/thread/synch.c
  - Lock init
  - Lock acquire
  - Lock release
- Testing
  - Command “sy2”
Atomic access

• spl = splhigh()
  • DisableInterrupts
• (Atomic section)
• splx(spl)
  • RestoreInterrupts

• Can be nested
  • spl = splhigh()
  • spl = splhigh()
  • splx(spl)
  • splx(spl)

Is still disabled here
Thread sleep and wakeup

- thread_sleep(void*addr)
- thread_wakeup(void*addr)
- (Please read the comments of these functions in thread.c)

- Interrupt must be disabled before calling these functions
- Wakeup or sleep using “addr” as identifier.

- Example:
  - One thread call thread_sleep(1), it will go to sleep state (not scheduled)
  - Another thread call thread_wakeup(1), it will wake the thread called thread_sleep(1)
  - If multiple threads used thread_sleep(1), all of them will wake up.
Implementing sleep lock

• Read and understand wait(P) and signal(V) code
• What’s the difference?
  • P <> lock_acquire and V <> lock_release ?

• A lock is similar to a semaphore
• Difference: https://stackoverflow.com/questions/62814/difference-between-binary-semaphore-and-mutex
  • Binary
  • Initial value
  • Ownership
Implementing CV

• CV data structure <- pthread_cond_t
  • kern/include/synch.h

• CV implementation
  • kern/thread/synch.c
  • CV init
  • CV wait
  • CV signal
  • CV broadcast

• Testing
  • Command “sy3”
Implementing CV: basic

• What’s the difference?
  • cv_wait <> P and cv_signal <> V ?

• You answered in midterm:
  • If no one is waiting,
    • V still counts (1 resource).
    • cv_signal will not.

• cv_broadcast ?
Implementing CV:

• Atomically, do the following: (for cv_wait)
  • Release the lock
  • Put thread to sleep (wake up some threads)
  • Re-acquire the lock

• Similar for cv_signal and cv_broadcast
Demo: spin lock

- Warning: DO NOT implement spin lock in your assignment. You need to implement sleep lock.
Q & A