Assignment 2
Non-preemptive scheduling

COS 318 - Operating System

Fall 2006

Main things you need to deal with

- Process Control Block (PCB)
- Context Switch procedure
- System Call mechanism
- Stacks
- Synchronization
- Inline assembly
- Design review requirements

Process Control Block (PCB)

- File: kernel.h
- What should be in the PCB?
  - pid, in_kernel, stack?
  - next, previous
- What else should goes in PCB?
  - Design review.

Context Switch Procedure

- How to switch between processes and threads?
  - They must call yield() explicitly.
  - Time slice expires. (Preemptive, next assignment)
- Where to save it?
  - Stack?
  - PCB.

System Call Mechanism

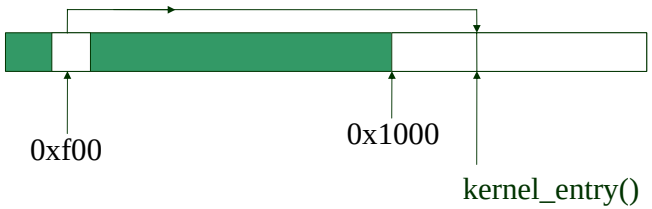
- How does a process get services from the kernel?
  - This assignment: special function call - a “jump table”
  - Real stuff: Interrupt/trap mechanism (later assignments)

System Call Mechanism (continued)

- At runtime, load the address of kernel_entry() into memory location 0xf00.
- How to do that?
  - Define this
    - #define ENTRY_POINT (void(**)(int))0xf00
  - Declare the following in syslib.c
    - void (**entry_point)(int)=ENTRY_POINT
  - To load
    - *entry_point = kernel_entry

System Call Mechanism (continued)

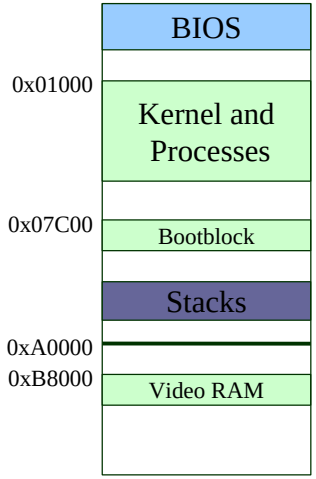
- The following diagram shows the kernel_entry in the memory



Stacks

- How many stacks?
  - 2 per process, 1 per thread. Why?
- Where to put them in memory?
  - Upper limit: 640K (= 0xa0000)
  - Suggestion: between 0x10000 and 0x20000
  - See memory layout on the next slide
- Size of each stack:
  - 4KB should be fine.

Memory Layout



Synchronization

- Locks are used by threads
- Many threads can try to acquire a lock
  - Need to maintain queue of threads waiting for a lock. (where?)
- Lock_acquire()
  - 1. Check lock
  - 2. Get lock? Great!
  - 3. If not, block itself
- Lock_init(), Lock_release()

Inline Assembly

- See guide on course page
  http://linuxassembly.org/articles/rmiyagi-inline-asm.txt (Extended Asm)
  http://linuxassembly.org/resources.html
- **Google.**
- **Ask us.**
- To access a C variable in inline assembly
  - **asm volatile("statements":output_regs:input_regs:used_regs);**
- Examples
  - **asm volatile("movl %%esp,%0":"=q"(cur_running->stack));**
  - **asm volatile("movl %0,%%esp"::"q"(cur_running->stack));**

Design Review Requirements

Please list your plan of actions for the following:

- Process Control Block (PCB)
  - What's in it ?
- Context Switch procedure
- System Call mechanism
- Stacks
- Synchronization
  - How are locks implemented ?

More hints: 1. Flat Address Space

- The bootblock code switches to protected mode. It also sets up the CS, DS, and other segment registers so that you can use the entire memory using just registers like *eax*.
- Do NOT modify the segment registers.
- You have access to the first 1MB of memory which includes the video-memory area(0xB8000).
- To be safe make sure your code, data, and stacks reside within the first 640KB of memory.

More hints: 2. Synchronization

- The synchronization primitives can only be used by threads within the kernel.
- You will notice that there are two functions block() and unblock() in the kernel that are to be used by the synchronization code.
- This has been done since blocking a process is not specific to locks, but is a general purpose service that the kernel should support.