

CS 460

Operating Systems

MWF 4:45-5:50pm

Chadd Williams

Office Hours Tues: 1-3pm
 Thur: 1-3pm

Overview

- Practical introduction to Operating Systems
- Topics
 - Purpose
 - History
 - Design Issues/Structure
 - Devices
 - System (Kernel) vs User mode
 - Concurrency/Deadlock
 - Processes/Threads
 - Multi-Core CPUs
 - Memory Management
 - Security

Syllabus

- *Operating System Concepts* (8th), Silberschatz, et al.

- Grades:

Midterm 1	15%	Mar	02
Midterm 2	15%	April	20
Final	15%	May	13
Homework/Quizzes/ Labs	15%		
Programming Projects	40%		

- **Quizzes:** frequent, unannounced, open-note quizzes will be given
- **Late Policy:** No late assignments accepted
- **Grade Complaints:** one paragraph summary of why the grade is wrong, **within one week of receiving the graded material**
- All projects are ***individual*** projects unless otherwise stated
- <http://zeus.cs.pacificu.edu/chadd/cs460s16>

Some of what I expect you to know

- C programming
 - arrays / pointers
 - structs
 - dynamic memory / Valgrind
 - Makefiles
 - argv/argc
- Linux command line
 - ls, cd, mkdir, cp, scp, mv, rm, &, vi/emacs/nano/pico/vim , >, <
- Eclipse
 - debugger
- Subversion

Introduction to Operating Systems

- Read Chapter 1!
 - Definition of an Operating System:
 - Kernel:
 - What is not part of the OS?
 - Linux vs GNU/Linux?
- Computers that need an OS:
 - How are their needs different?

Goals of the OS

- Perspectives:
 - User View:
 - Who is the user?

 - System View:
 - Who is the system?

The Computer

- What does a computer really look like?

- Startup Sequence

We booted!

- Now what?
- Interrupts:
 - Characteristics:
 - Hardware:
 - Software:
 - Trap
 - Interrupt vector:

Memory System

- Random Access Memory

- Registers
 - Instruction register
 - data registers
 - load
 - store

- Caches

Disk Storage

- Magnetic Tape
- Magnetic Disks
 - RAM spills over to disk
 - Virtual memory
- USB drives
 - Flash memory

Devices

- Device controller
 - specialized chip
 - buffer

- Device driver

System Architecture

- Single Processor System
- Multiprocessor System
 - Increased throughput
 - Speed up approaches N for N processors (Ahmdal's Law)
 - Economy of scale
 - Increased reliability
 - Asymmetric MP
 - SMP
- Multi core System
 - dual-core
 - quad-core

System Architecture, cont.

- Blades

- Clusters
 - One OS many computers
 - Beowulf cluster - <http://www.beowulf.org/>

OS Pieces

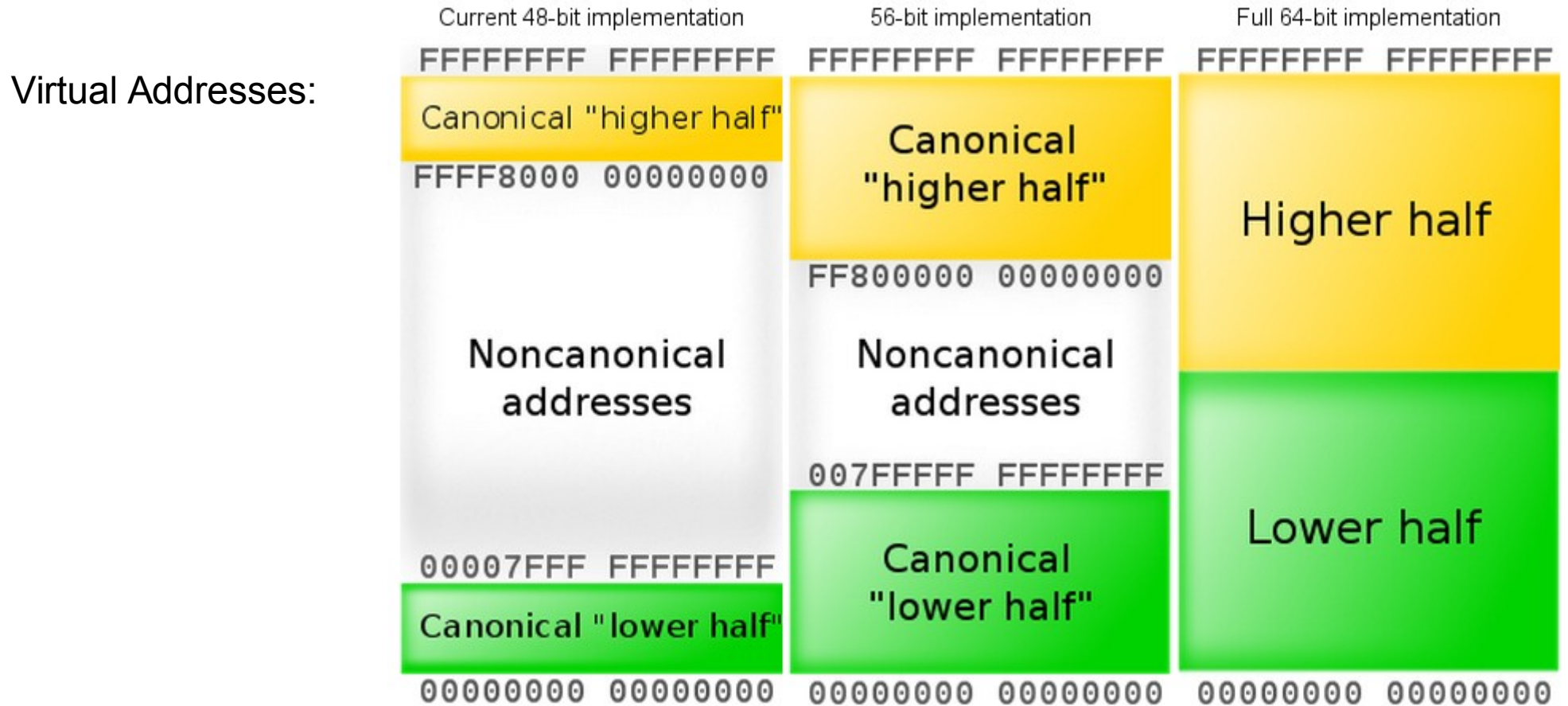
- Multiprogramming
 - Job
 - Switching
- Time sharing/multitasking
 - Response time
 - Pre-emptive MT
- Process
- Scheduling
 - Job
 - CPU

OS Pieces, cont.

- Virtual Memory
- Physical Memory
- Security

Virtual Memory, AMD64

- AMD64 is not currently implemented to use all 64 bits of **virtual** memory addressing.



<http://en.wikipedia.org/wiki/File:AMD64-canonical--48-bit.svg>

```
/usr/sbin/hwinfo | grep bits
address sizes : 48 bits physical, 48 bits virtual
```

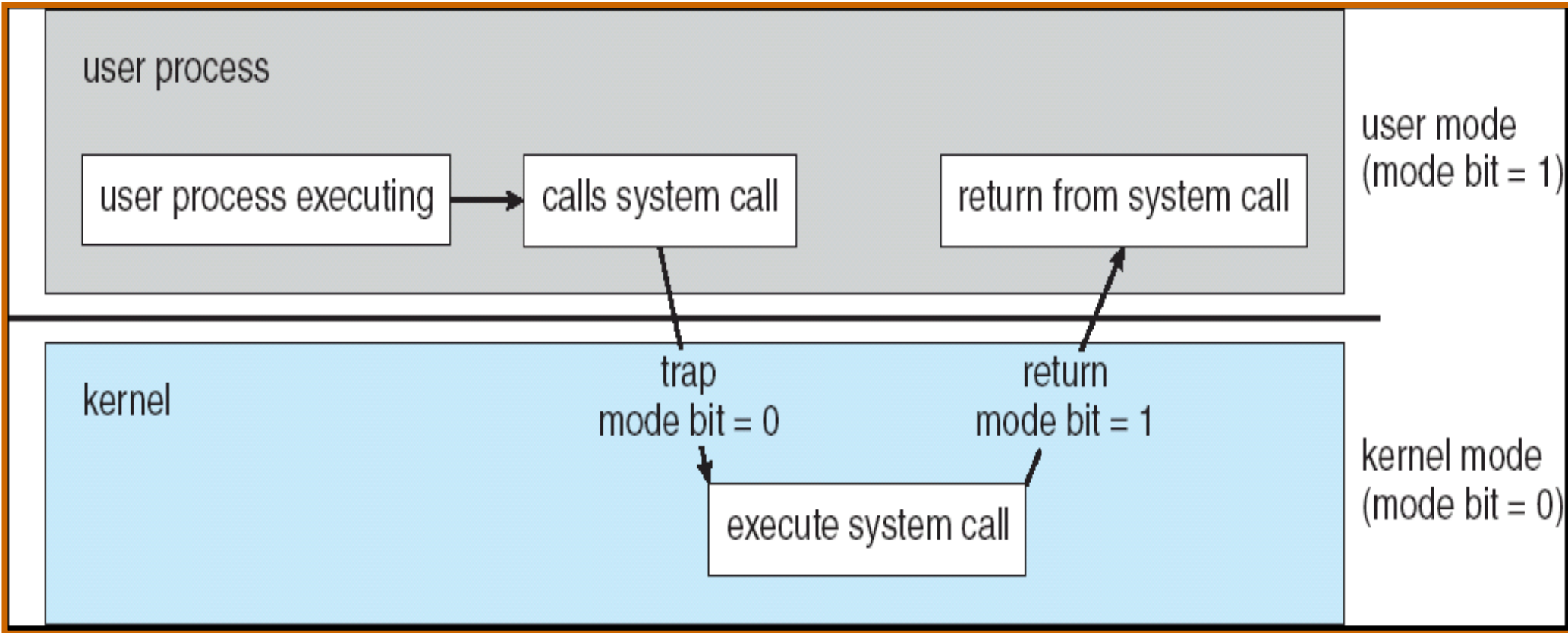

Operation

- Dual Mode
 - Kernel mode
 - { Supervisor | System | Privileged } mode
 - Hardware bit
 - Privileged instructions
 - Based on CPU type
 - I/O control
 - Interrupt management
 - Stop/Halt
 - Memory management
 - User mode
 - **System calls**

No mode bit on the original Intel 8088 chip

Hence, MS-DOS originally not dual mode!

Dual-Mode, in action



Process Management

- Process
 - Active program
 - Resources

Memory Management

Read Chapter 2