CMSC412

Project 0

The usual

- Info:
  - http://www.cs.umd.edu/~hollings/cs412/s10/
- Recitation:
  - Wed 9:00-9:50
  - Wed 10:00-10:50
- TAs:
  - Robert Grove, Nick Frangiadakis

Why are we here

- To get you started on the project and answer your questions
- Give you background material
- Show you how the concepts you learn apply to GeekOS.

Why are we here

- _not_ to tell you where and what to code!
- Pointers:
  - The lab is about GeekOS: so *read* the source
  - You'll be implementing major functionality into the base kernel.
  - So start early…
  - Challenging but fun!

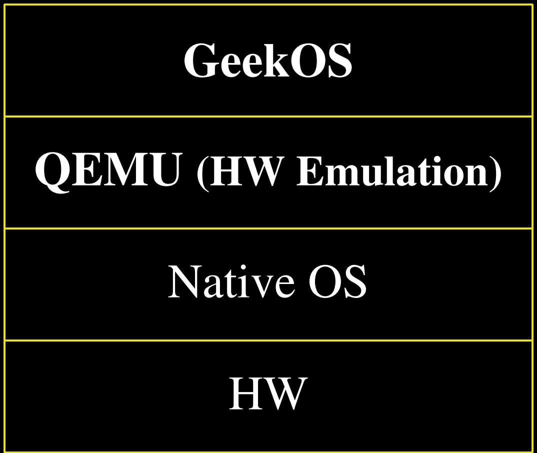
Start Early

Project 0

- Setup:
  - QEMU
  - GeekOS base setup
- Project requirements:
  - Resource restrictions on GeekOS processes:
    - # of active processes
    - # of syscalls by a single process

Project0 lessons…

- You have learned:
  - The QEMU simulation setup is:



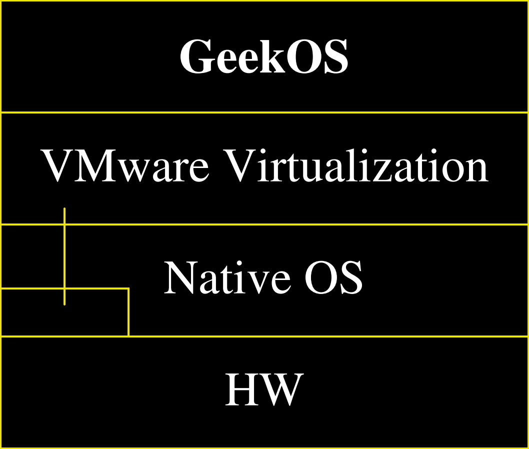
GeekOS

QEMU (HW Emulation)

Native OS

HW

  - Alternatives:

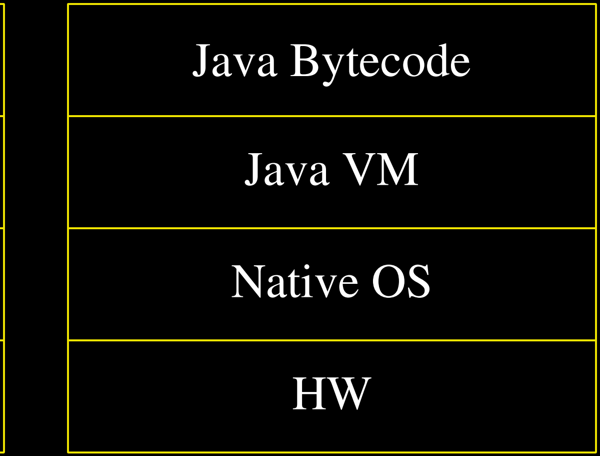


GeekOS

VMware Virtualization

Native OS

HW

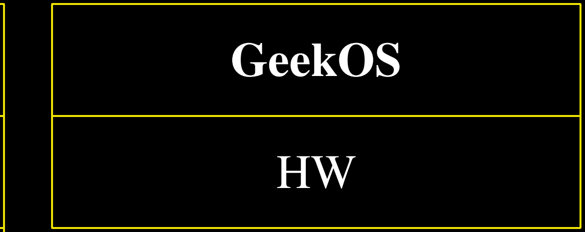


Java Bytecode

Java VM

Native OS

HW



GeekOS

HW

Project0 Lessons…

- You have learned:
  - About GeekOS:
    - Reading the source code is good and works!
    - OS split in two: *User-level* and a *Kernel-level*
    - Connected by the *System call* boundary
    - GeekOS user processes are just kernel threads with a special User_Context structure
    - grep is your friend

In more detail: System Calls

- Software interrupt
  - The only interrupt callable from user level idt.c #Init_IDT
  - SYSCALL_INT: 0x90
- Operation: syscall.h; syscall.c; libc/process.c
  - Put args in registers on user side; raise INT
  - Recover them on kernel side
  - Call the appropriate Sys_XXX
  - Return result/error code in appropriate register
- Use g_CurrentThread for information about who raised it

In more detail: Thread System

- In the kernel
  - Each thread is a Kernel_Thread object: kthread.h
- Current thread: g_CurrentThread global
- User mode threads
  - Kernel_Thread objects with a populated User_Context
- User mode -> kernel mode execution: *syscall*
- Kernel vs user memory
  - Distinct views: one from the user and one from the kernel
  - Kernel needs to access user memory
  - Use Copy_From_User/Copy_To_User

In more detail: The system queues

- Thread_Queue structure
- Run queue:
  - Threads which are ready to run, but not currently running
  - GeekOS has a single run queue, as of the moment
- Wait queues:
  - Threads that are waiting for a specific event or on a specific device; eg Keyboard IO, network IO, other threads: geekos/kthread.c#Join()
  - Spend 2 mins: follow the Get_Key syscall to see how the thread eventually gets to the keyboard wait queue

In more detail: Interrupts

- Types:
    - Illegal operations: *result in kills*
    - Faults: page faults etc: *not of concern right now*
    - h/w interrupts
    - s/w interrupts: *syscall int*
- Interrupt handlers
    - src/geekos/int.c
    - On completion -> control returns to thread that was interrupted

Interrupts

- When you don’t want to receive them:
  - When you are modifying global data structures; queues etc
  - When you want to make some operation atomic
- Disable_Interrupts() / Enable_Interrupts():
    - Can use Disable_Interrupts(): include/geekos/int.h
    - Extreme caution
    - Enable_Interrupts() when atomic operation finished
    - See places where this has been done: eg src/geekos/user.c#Attach_User_Context() and src/geekos/kthread.c#Reaper()
  - Begin_Int_Atomic() / End_Int_Atomic()
    - Oblivious way of saving and restoring interrupt state.
    - include/geekos/int.h