CS 1550

Week 2

Lab 1 – xv6 Introduction

Setup and exercise

Teaching Assistant

Henrique Pötter

Recitation TA – Office Hours

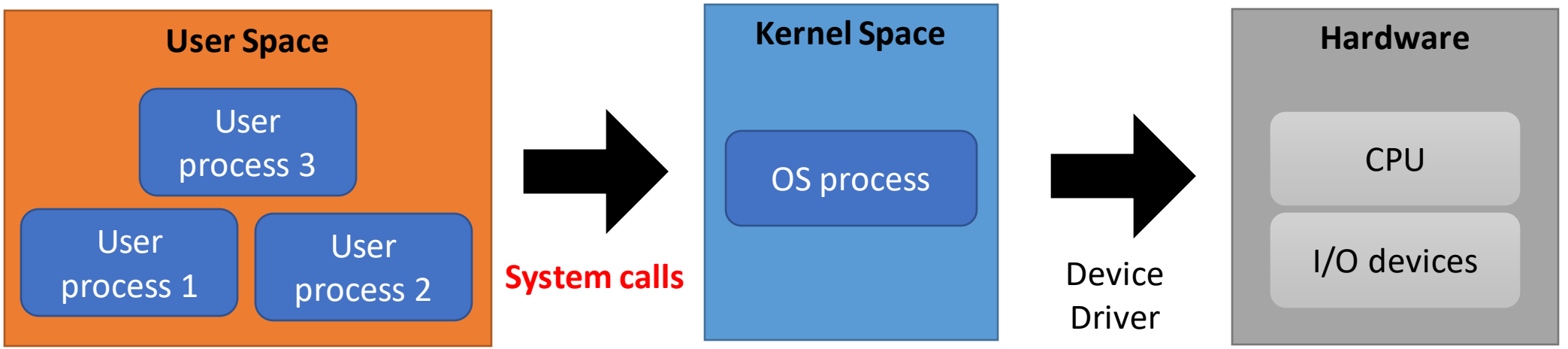
- Office Hours (Link)
  - Monday 10:00 AM - 12:00 PM
  - Wednesday 10:00 AM - 11:00 AM / 12:00 PM - 1:00 PM
  - Friday 11:00 AM - 1:00 PM
- Email
  - potter.hp@pitt.edu
- TA Website (Spring 2020)
  - http://people.cs.pitt.edu/~henriquepotter/

CS 1550 – Lab 1 is out

- **Lab 1**
  - Create a syscall in xv6 that will return the number of times other syscalls were called.
- **Due**: Tuesday, 09/15 @ 11:59pm

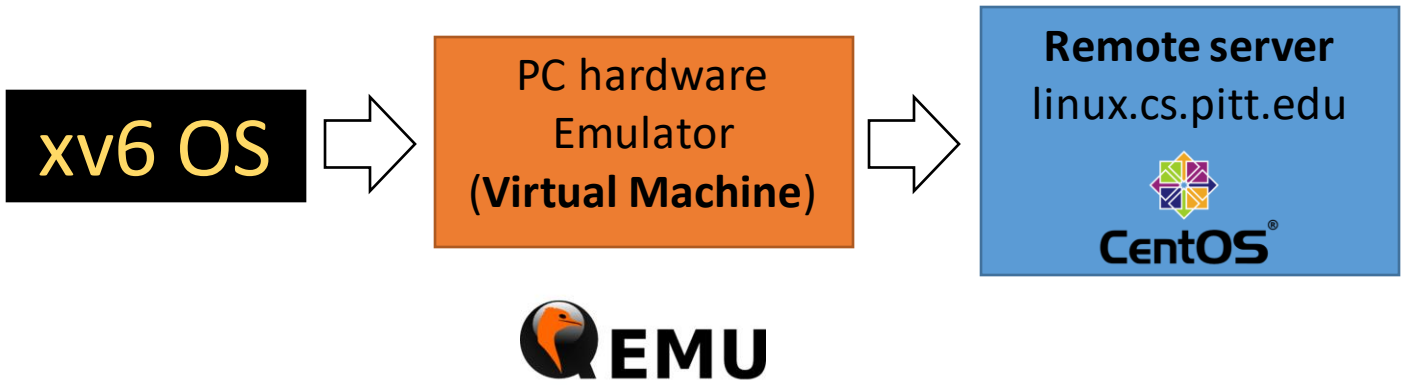
CS 1550 – Kernel Space vs User Space

- **System Call (OS function)**
  - User processes must execute system calls to access OS resources and hardware



CS 1550 – xv6

- Compile and Run xv6 in a cs pitt server



CS 1550 – xv6 Lab 1

- We need to worry about two things:
  - How to count syscalls?
  - Implement the method to return the number of syscalls

CS 1550 – xv6 exercise hints

- Syscall calls will need a variable to hold the counting values
  - Where to write this data structure?
    - Which file holds processes metadata? proc.c
  - Which data structure?
    - Each syscall have an id, which could be used as?
    - Which basic data structure uses indices for element positions?
  - Important method can be found in syscall.c
    - syscall(void) -> Is called every time any syscall is called

CS 1550 – xv6 exercise hints

```
void
syscall(void)
{
  int num;
  struct proc *curproc = myproc();

  num = curproc->tf->eax;
  if(num > 0 && num < NELEM(syscalls) && syscalls[num]) {
    curproc->tf->eax = syscalls[num]();
  } else {
    cprintf("%d %s: unknown sys call %d\n",
            curproc->pid, curproc->name, num);
    curproc->tf->eax = -1;
  }
}
```

The system call numbers match the entries in the syscalls array, a table of function pointers

CS 1550 – xv6 exercise hints

- Implementing **getcount**
  - Specify the method and its **id** in **syscall.h**
  - Specify extern method and pointer
    - **syscall.c**
  - Where to implement int **sys_getcount(void)**?
    - **sysproc.c**
  - Add SYSCALL(getcount)
    - **usys.S**
  - getcount.c
  - Modify proc.c, proc.h according to your method of counting.
    - Declare counting array?
    - Initialize counting array?
  - Makefile

CS 1550 – xv6 exercise hints

- Submit to GradeScope the files that you have modified within the source code of xv6.
- You should modify the following files only:
  - syscall.h
  - syscall.c
  - user.h
  - usys.S
  - proc.h
  - proc.c
  - sysproc.c
  - Makefile

Project 1

Setting up the environment

Setting up environment for Project 1

- We will compile a **Linux** distro from source

Setting up environment for Project 1

1. First log to your **thoth.cs.pitt.edu** account
   - Command line
   - Terminal
   - PowerShell

Setting up environment for Project 1

1. First log to your **thoth.cs.pitt.edu** account
   - Command line
   - Terminal
   - PowerShell
2. Navigate to **/u/OSLab/username**
   - Copy linux source from /u/OSLab/original/linux-2.6.23.1.tar.bz2
     - **Run** cp /u/OSLab/original/linux-2.6.23.1.tar.bz2 .

Setting up environment for Project 1

3. Extract files locally
   - Run tar xfj linux-2.6.23.1.tar.bz2

Setting up environment for Project 1

3. Extract files locally
   - Run tar xfj linux-2.6.23.1.tar.bz2
4. Move into **linux-2.6.23.1/**
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Setting up environment for Project 1

3. Extract files locally
   - Run tar xfj linux-2.6.23.1.tar.bz2
4. Move into **linux-2.6.23.1/**
   - Run cd linux-2.6.23.1
5. Copy the .config file
   - Run cp /u/OSLab/original/.config .

Setting up environment for Project 1

3. Extract files locally
   - Run tar xfj linux-2.6.23.1.tar.bz2
4. Move into **linux-2.6.23.1/**
   - Run cd linux-2.6.23.1
5. Copy the .config file
   - Run cp /u/OSLab/original/.config .
6. Build linux source code
   - Run make ARCH=i386 bzImage

Setting up environment for Project 1

- Repeating from step **2** will give you a new environment
  - This will not be necessary unless you really need to

Setting up environment for Project 1

- To add the changes you will need to rebuild the Kernel
  - Run again make ARCH=i386 bzImage

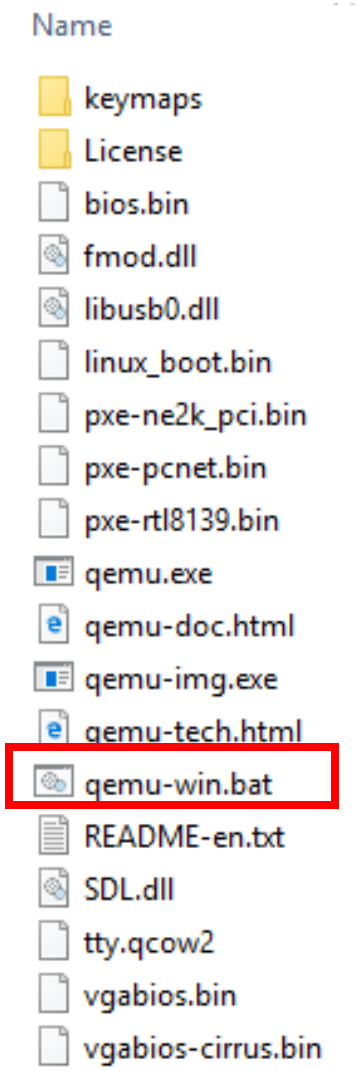
Configuring QEMU

- We need a x86 version of QEMU (username and pass is **root**)
- Windows Users
  - Download QEMU and an Image from this link
  - Unzip qemu_windows.zip
- Mac Users
  - Install homebrew, from brew.sh
  - In terminal, run:
    brew install qemu
  - Download QEMU and an Image from this link
  - Unzip qemu-mac&ubuntu-img(only).zip
- Ubuntu Users
  - In terminal, run:
    apt-get install qemu
  - Download QEMU and an Image from this link
  - Unzip qemu-mac&ubuntu-img(only).zip
- Detailed guidance
  - https://github.com/Henrique-Potter/Pitt_CS1550_recitation_materials/tree/master/project1

Configuring QEMU

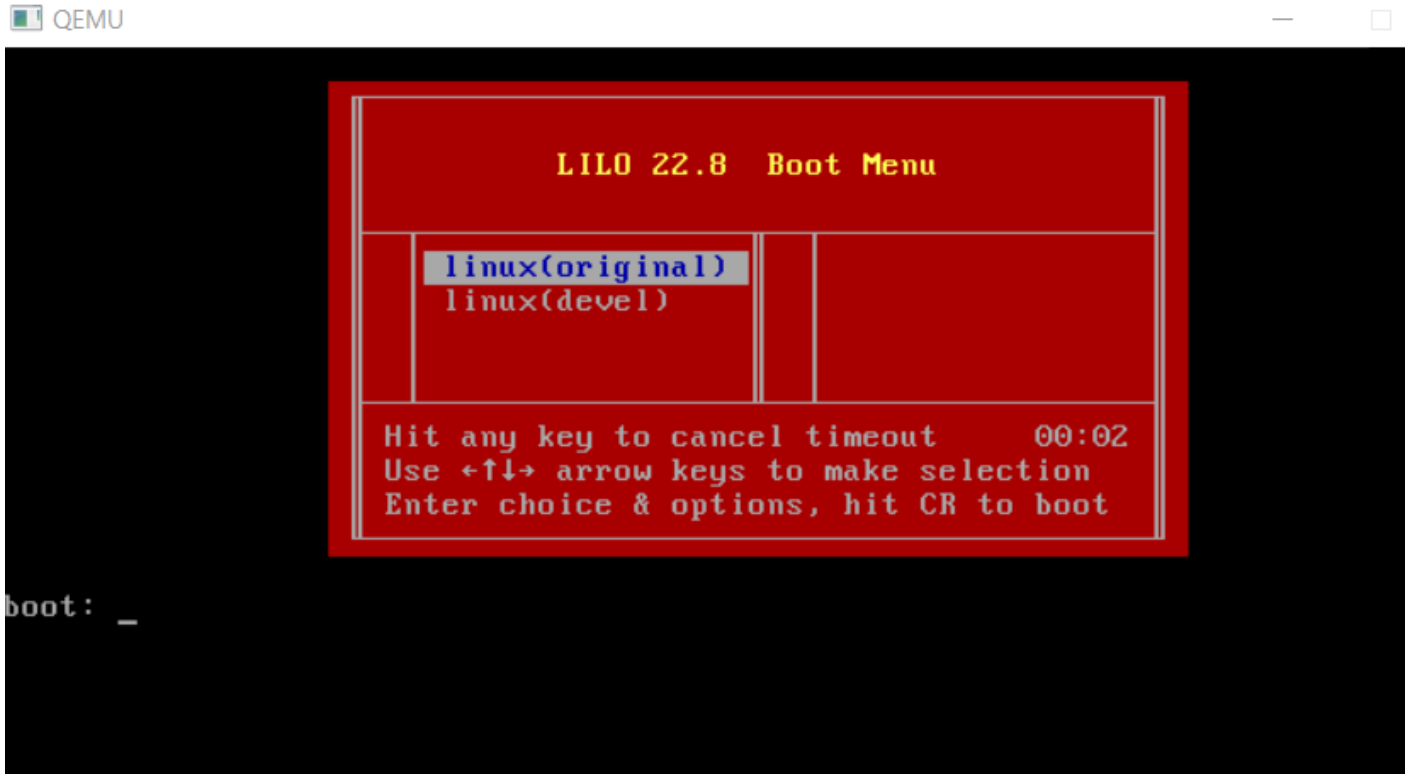
- Windows:
  - double-click/execute qemu-win.bat
- Mac/Ubuntu
  - Run the script:

    ./start.sh



Configuring QEMU

- Choose Linux(original)
  - User '**root**' as user and password



Copying files from Linux to QEMU

- Now we need two files from the Linux we just built
  - Kernel File **bzImage** from:
    - linux- 2.6.23.1/arch/i386/boot/
  - System call map **System.map** from:
    - linux-2.6.23.1/

- Please be sure about **the path** where **you copied** the **linux distro!**
  - If you follow the step here the linux files should be in **/u/OSLab/**username

Copying files from Linux to QEMU

- **FROM WITHIN THE NEW QEMU**

- Download the files from your compiled Linux:
  - **scp** USERNAME@thoth.cs.pitt.edu:**/u/OSLab/**username /linux-2.6.23.1/arch/i386/boot/**bzImage** .
  - **scp** USERNAME@thoth.cs.pitt.edu:**/u/OSLab/**username /linux-2.6.23.1/**System.map .**

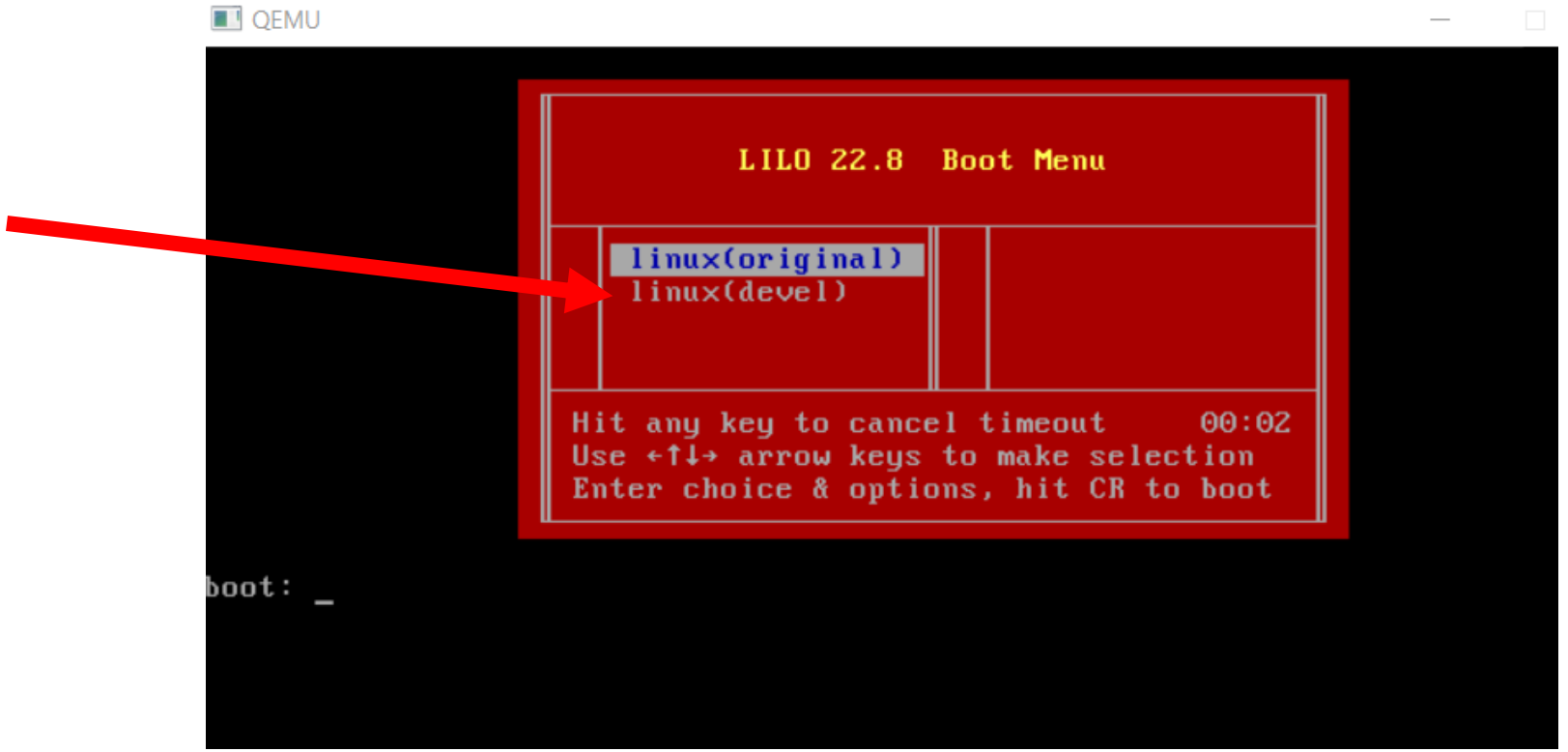
- Install the rebuilt kernel in QEMU:
  - cp bzImage /boot/bzImage-devel
  - cp System.map /boot/System.map-devel

Copying files from Linux to QEMU

- After this run **li**nux **lo**ader command:
  - Run **lilo**
- This will relink the new modified kernel you just copied
- Then reboot the system with the command:
  - Run **reboot**

Copying files from Linux to QEMU

- You will change to **linux(devel)** kernel
  - So to see changes always remind to choose it when opening Qemu



CS 1550 – Reminder

- **Lab 1**
  - **Due**: Tuesday, 09/15 @ 11:59pm