1 Objective

In this assignment, you will make a small change to the Linux kernel, compile the kernel, and boot to your newly compiled kernel. All work will be done in a virtual machine (VMware). You will need to know how to compile the kernel to complete future assignments.

2 Resources

The resource links found at the bottom of our course web page will be very helpful for this lab assignment.

3 Assignment

For this lab assignment, the most important thing for you to do is follow my instructions to the letter. Nothing can be more frustrating then compiling and installing your kernel incorrectly.

3.1 VMWare preparation

3.1.1 Copy the virtual machine image

In the following, “userid” is to be substituted with your userid. For example, since my userid is mhaungs, I would type in “mkdir /vm/mhaungs” in step (1). Also, you should be working on the computers in 14-232A.

1. mkdir /vm/userid
2. cd /vm/userid
3. wget http://www.csc.calpoly.edu/~mhaungs/courses/vm/SUSE_10.tar.gz
4. tar xvzf SUSE_10.tar.gz
5. rm SUSE_10.tar.gz
6. cd
3.1.2 Startup VMWare and run virtual machine

1. vmware &

2. In the “Connect to host” window, click on “local host” and then hit “connect”.

3. To select the virtual machine to run, do the following:

   (a) In the commands panel, click on the “open a virtual machine”
   
   (b) Click on “browse”, click on “vm” (in places panel), click on the folder that has your userid as its name

   (c) Click on the “SUSE_10” folder and, finally, select “suse.vmx” and click open.

4. Start the guest operating system (button in the commands panel).

5. You will be asked a question in a popup about identifiers, choose the “create” option.

6. Ignore messages about sound, serial ports, parallel ports, or kernel version.

7. Your virtual machine will now bootup (this will take awhile).

3.1.3 Login in

You have two accounts on your virtual machine. The first is the “root” account who’s password is “abc123”. ONLY USE THIS ACCOUNT WHEN INSTRUCTED BY THE LAB WRITEUP. The second account is the one you will log into to do a majority of your work. The account is “student” and it’s password is also “abc123”.

TIPS:

1. When the instructions say, “Log on as root” you shouldn’t logout of the student account and then login as the root account. Instead, use the “su” command (stands for superuser). In a shell, type “su” and you will be prompted for root’s password. You will then be logged on as root in that shell. When you are done, you type “exit” and you will revert back to using that shell window with your normal privileges.

2. Even though these are virtual machines, they can still loose data and become unbootable if they are not shutdown properly. When you want to exit out of your virtual machine. “su” to root and type the following command, “shutdown -h now”. This will cause a proper shutdown of your virtual machine.

3.2 Preparing the Linux source

The first thing we need to do is make a fresh copy of the kernel source that you can modify and do some preparation for later compilation. The steps below assume you are logged onto your virtual machine using the “student” account. Do the following steps in order:

1. Create a directory for your copy of the kernel in your account. cd into that directory.

2. Try pinging google, “ping www.google.com”. If that fails you need to do the following to fix your networking:

   (a) Click on the KMenu button on the lower task bar (equivalent to MS Window’s Start button)
   
   (b) System->Control Center (YaST)

   (c) Enter the root password.

   (d) Choose “Network Devices->Network Card”.
(e) Edit the entry that shows as “not configured”.
(f) Select the DHCP option and then hit “ok”.
(g) Hit next and the network card will get configured.
(h) Try pinging google again.

3. wget http://www.kernel.org/pub/linux/kernel/v2.6/linux-2.6.15.tar.gz
4. tar xvfz linux-2.6.15.tar.gz
5. mv linux-2.6.15 linux-2.6.15-Lastname (substitute you own last name in place of “Lastname”)
6. cd linux-2.6.15-Lastname
7. make clean; make mproper; make clean
8. wget http://www.csc.calpoly.edu/~mhaungs/courses/vm/SUSE10-2.6.15-Haungs.config
9. mv SUSE10-2.6.15-Haungs.config .config
10. vi Makefile and change “EXTRAVERSION = ” to “EXTRAVERSION = -Lastname” where you sub-
    titute your own last name in place of “Lastname” and the save and quit vi.
11. make -j2 > /dev/null (Note: This will take a long, long time. About 45 mins)
12. logon as root (You need to do these last steps as root)
13. make modules_install
14. cp arch/i386/boot/bzImage /boot/vmlinuz-2.6.15-Lastname (Again, substitute your lastname)
15. cp System.map /boot/System.map-2.6.15-Lastname (Again, substitute your lastname)
17. Append the following to /boot/grub/menu.lst. Be sure to follow the existing formatting conventions
    in /boot/grub/menu.lst:

```
title student

    root (hd0,1)

    kernel /boot/vmlinuz-2.6.15-Lastname root=/dev/sda2 vga=0x332 selinux=0
    resume=/dev/sda1 splash=silent showopts

    initrd /boot/initrd-2.6.15-Lastname
```
18. reboot

Hopefully, the virtual machine will boot to your new custom kernel. At the boot screen, select the “student”
kernel. Logon and type “uname -a” after the virtual machine reboots. You should see something like “Linux
< machinename > 2.6.15-Lastname < today's date > < stuff > GNU/Linux”. Notice the name of the kernel and
the date information.
3.3 Making a small change

Let’s make a small change to the kernel. We’ll print a customized message after the kernel initializes the processor, console, and memory. Do the following:

1. cd <yourLinuxdirectory>/linux-2.6.15-Lastname (Again, substitute your lastname)
2. cd init
3. vi main.c
4. After the calibrate_delay() function in the function start_kernel() function, add the following line:
   “printk("Ag burgers rule!
\n");”
5. save and exit vi

3.4 Compiling

The steps you did in Section 3.2 was a one time deal. From now on, when you modify the kernel you just need to do the following to compile:

1. cd <yourLinuxdirectory>/
2. make
3. logon as root
4. cp arch/i386/boot/bzImage /boot/vmlinuz-2.6.15-Lastname (Yes, replace your older version)
5. cp System.map /boot/System.map-2.6.15-Lastname (Yes, replace your older version)
6. reboot

The virtual machine will boot to your new custom kernel. Logon and type “uname -a” after the machine reboots to double check that you are running the latest version of your kernel. Type “dmesg | grep burgers”. You should see your custom message.

Deliverables

In Lab, on Thursday, February 5, I will have you boot to your modified kernel. Lab on that day is MANDATORY in order for you to get a grade for this assignment.