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

You shouldn’t need any external resources to complete this lab.

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 than 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/CentOS5.tar.bz2
   (a) NOTE: I also have a simpler (e.g., no window manager) virtual machine you can use. However, be warned, the directions will differ slightly. The image is named JEOS_8.4.tar.gz and is located at the same location.
4. tar xvfj CentOS5.tar.bz2
5. rm CentOS5.tar.bz2
6. mv CentOS5.vmwarevm CentOS5_userid.vmwarevm
7. cd
3.1.2 Startup VMWare and run virtual machine

1. vmware &
   
   (a) Firefox will start and give you an interface to VMWare. Note: Firefox may ask you to add a security certificate exception for vmware: go ahead and do so.

2. Login (userid=vmware; password=vmware)

3. To select the virtual machine to run, do the following:
   
   (a) Click on the “Virtual Machines” tab and then click on the “Add Virtual Machine to Inventory” command.
   
   (b) In the Inventory column, open machine_name->standard->(your_userid)->CentOS5_userid.
   
   (c) Select “CentOS5.vmx” and hit “Ok”.

4. Select “CentOS5” in the “Virtual Machines” tab and then click on “Power On” (a link on the right-hand side).

5. In the “Inventory” column, select “CentOS5” and then click the “Console” tab.
   
   (a) Click “Install Plug-in”
   
   (b) When prompted, restart Firefox

6. When Firefox comes back up, login again

7. Select “I_copied_it” and hit “Ok”.

8. Click on the “Console” tab and click in the window.

9. Eventually, another window will open showing your virtual machine booting.

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. To protect your virtual machine, you should change the password for both student and root. To do so, login as each and use the “passwd” command.
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 fix your networking. Either “Google it” or ask me for some help.
4. tar xvfj linux-2.6.24.7.tar.bz2
5. mv linux-linux-2.6.24.7 linux-2.6.24.7-Lastname (substitute you own last name in place of “Lastname”)
6. cd linux-2.6.24.7-Lastname
7. make clean; make mrproper; make clean
8. cp /boot/config-2.6.18-92.1.22.e15 .config
9. make menuconfig (Just look at some of the options, exit, and select “yes” to saving the config file.)
10. vi Makefile and change “EXTRAVERSION = .7” to “EXTRAVERSION = .7-Lastname” where you substitute your own last name in place of “Lastname” and the save and quit vi.
11. make > /dev/null (Note: This will take a long, long time. About 45 mins)
12. make modules (Note: This also takes some time.)
13. logon as root (You need to do these last steps as root)
14. make modules_install
15. make install
16. reboot

Hopefully, the virtual machine will boot to your new custom kernel. At the boot screen, hit the “space” bar and then select your custom kernel. Logon and type “uname -a” after the virtual machine reboots. You should see something like “Linux <machinename> 2.6.24.7-Lastname <today’s date> <stuff> GNU/Linux”. Notice the name of the kernel and the date information.

NOTE: You can enter X by typing “startx” at the command prompt. If you want to switch the display resolution, choose System->Administration->Display.

3.3 Making a small change

Let’s make a small change to the kernel. We’ll add a new kernel command line argument. The name of the argument is “haungsmoed” and, if present, the kernel should print “Who watches the Watchmen?” after the kernel initializes the processor, console, and memory. Do the following:

1. cd <yourLinuxdirectory>/linux-2.6.24.7-Lastname (Again, substitute your lastname)
2. cd init
3. vi main.c
(a) Look at how kernel command line “reset_devices” is coded. This provides an example of how you should code the “haungsmode” kernel parameter. What does EXPORT_SYMBOL() do? Do you need it for this assignment?

4. Add your print statement after the calibrate_delay() function in the function start_kernel() function. Note, you must use “printk” instead of “printf”. Why? Be sure to only print that statement if “haungsmode” was given as a kernel command line argument.

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. make install
   5. 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 Watchmen”. You should see your custom message.

Deliverables

In Lab, on Thursday, April 16, 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.