Lecture 2: Installing/Reading Linux Kernel

1. What's in the linux kernel

init: start up code

main.c : beginning of linux

kernel: cpu-indendent code for basic system management

fork.c, exit.c, sched.c : process creation, exit, scheduling

arch : cpu-dependent code for basic system management

arch/x86 : cpu-dependent code for intel x86 cpu

arch/x86/boot : boot-related code

arch/x86/kernel: low-level intel cpu code for initialization, interrupt handling, etc

entry\_32.S : code for interrupt entry point

head\_32.S : code for system initialization

i8259\_32.c : code for interrupt controller

irq\_32.c : code for IRQ

process\_32.c : code for process control

time\_32.c : code for timer

traps\_32.c : code for exception handling

signal\_32.c : code for signal handling

fs: file system code

open.c, read\_write.c, file.c, ... : fs system call handling

inode.c : inode handling

fs/ext2 : ext2 file system code

fs/ntfs : windows NT file system code

mm : memory management code

net: network handling code

drivers: device handling code

include : include files

inclde/asm-x86 : include files for intel cpu specific code

ipc: code for inter-process communication

2. Linux starting location: init/main.c: start\_kernel()

3. homework

1) Install Gentoo Linux on virtual machine.

1.0) Download Virtualbox from Internet and install.

1.1) Download Gentoo virtualbox files (gentoo.zip) from the I-class and un-compress it.

1.2) Run VirtualBox, and click File>Import and go to the gentoo directory. Select Gentoo2.ovf. Uncheck USB controller. Select Import. This will install Gentoo Linux on your virtual box. You can export your gentoo to your usb and bring it home later. In the directory, vmdk is the hard disk image, ovf file has the VM configuration, and mf file contains UUID's of the VM. UUID stands for Universal Unique IDentifier.

1.3) Run Gentoo. If you have an error, run VirutalBox as administrator and try again. For USB error, simply disable usb controller in "Setting" tab. For Hyper-V error (Raw-mode is unavailable), turn off Hyper-V feature in control panel>program and feature>window feature. Select My Linux. Login as root and hit Enter for the password prompt. If VirtualBox still cannot open the session, you need to look at the log file (right click on Gentoo VM and select “log file”) and see what is the error and fix it.

(In some cases, you may need to download and install virtualbox extension package.)

1.4) Make a simple program that displays "hello world". Compile and run it.

2) Go to linux-2.6.25.10 directory and find all the files referred in Section 1 such as main.c, fork.c, entry\_32.S, etc.

3) Find the location of start\_kernel().

To find a string "start\_kernel", go to the linux top directory (linux-2.6.25.10) and do

$ grep -nr "start\_kernel" \* | more

Use "space" to move down the screen, "q" to exit

Once you found the file that has "start\_kernel", use "vi" to read the file.

In vi, type "/start\_kernel" to search for the first instance of "start\_kernel".

For the next string, simply type "/". Repeat "/" until you find the start\_kernel() function.

Use "j" to mode down the cursor, "k" to move up, "^f" to move one screen down, "^b" to move

up one screen up.

4) start\_kernel() is the first C function run by Linux. Predict what will be the first message appearing on the screen by analyzing start\_kernel(). Note that "printk()" (not "printf") is the function to print something in the kernel. Confirm your prediction with "dmesg > x" and "vi x". The kernel remembers the booting message in the system buffer and dmesg displays the content of this buffer to the screen. "dmesg > x" will send the booting message to file x. With "vi x" you can look at the file x.

5) Find the location of the following functions called in start\_kernel() and briefly explain your guessing about what each function is doing (but do not copy the whole code).

trap\_init(), init\_IRQ(), sched\_init(), time\_init(), console\_init(), mem\_init(),

rest\_init()

6) Why can't we use "printf" instead of "printk" in Linux kernel?