

CS 460 -- In Class Lab
April 11, 2012

Linux Loadable Kernel Module
Blink your Keyboard Lights

10 points

Goal:

Write a simple loadable Linux module that blinks the lights on your keyboard.

Resources: Beware! Many of these resources are written for a 2.6 Linux kernel!

<http://lwn.net/Kernel/LDD3/>
<http://www.ibm.com/developerworks/linux/library/l-lkm/>

<http://tldp.org/LDP/lkmpg/2.6/html/x569.html>
<http://tldp.org/LDP/lkmpg/2.6/html/lkmpg.html#AEN1194>
<http://tldp.org/HOWTO/Module-HOWTO/x73.html#AEN107>

http://www.freesoftwaremagazine.com/articles/drivers_linux
http://www.xatlantis.ch/education/linux_driver_example.html

<http://rkalimuthu1987.blogspot.com/2010/08/simple-character-device-driver.html>
<http://linuxgazette.net/125/mishra.html>

This one gave me the Makefile
<http://www.pradeepkumar.org/2010/03/writing-a-simple-character-device-driver-in-linux.html>

The Makefile

```
obj-m += kbleds.o
```

```
all:
    make -C /lib/modules/$(shell uname -r)/build M=$(PWD) modules
```

```
clean:
    make -C /lib/modules/$(shell uname -r)/build M=$(PWD) clean
```

Setup the Virtual Machine:

Step 1:

Boot the computer into the BIOS to allow VirtualBox to run.
Press Delete at the large, green AMD screen during boot.
Advanced / CPU -> Secure VM Enabled

Step 2: Unzip the virtual hard driver file. You must be on one of
{moe, apu, maude, ned, marge, burns, ralph, maggie, rod, homer}
tar xzf /home/ArchLinuxStudent.vdi.tar.gz /home/PUNetID

Step 3: Build the Virtual Machine in Virtual Box

barney:~> VirtualBox &

New
Next
Name: ArchLinuxCS460
Operating System: Linux
Version: Arch Linux (64 bit)
Next
4096 MB
Use Existing Hard disk
<Use the Icon to the right to find ArchLinuxStudent.vdi>
Finish

Storage
SATA Controller
Use host I/O cache

System
Enable IO APIC
Processor
2 CPU

Start

login: root
password: CS460!!pac

OR

login: cs460
password: cs460!!pac

Enable the USB keyboard:

At the bottom of the VirtualBox window, right-click the little USB cable. Select the keyboard.

Be very careful to not select the mouse!

Building the Kernel Module

Follow the instructions at the following link to create a kernel module in a directory named CS460_kbleds. Use the Makefile shown above.

<http://tldp.org/LDP/lkmpg/2.6/html/lkmpg.html#AEN1194>

DIFFICULTY: The source code as written will not work with the 3.1.9 version of the kernel. You will need to look at the data structures provided by the kernel to determine how to change the code to get the module to compile and run.

For example, you will need to add

extern int fg_console;

in the source file and the “NULL,” in the **my_driver->ioctl** line in **my_timer_func** needs to be removed.

You can look in the kernel sources installed at: **/usr/src/linux-3.1.9-2-ARCH/** or use the Linux Cross Reference website we have been using in class.

In the module source code, make a comment on each changed line describing the change(s).

Once you have the kernel module built, load and unload the module to ensure that it works. Show the instructor. (insmod, rmmod)

Oscillate! (BONUS)

Create a second kernel module that blinks the keyboard lights.

This kernel module must have the blinks happen further and further apart the longer the module is running. When the blinks reach some maximum distance apart, have the blinks begin to happen closer together until they reach some minimum distance. Loop.

► Before class on Friday you must demonstrate your first kernel module to me. I will want to see the source code and the changes you needed to make. You must also have your kernel module saved in Subversion.

Save your work!

```
tar czf CS460_kbleds.tar.gz CS460_kbleds/  
scp CS460_kbleds.tar.gz punetid@zeus:
```

You can also add the CS460_kbleds directory to Subversion.

make clean # only commit the .c file and Makefile

```
cd ..
```

```
svn import CS460_kbleds svn+ssh://pUNETID@zeus/home/pUNETID/SVNROOT/CS460_kbleds -m  
"First import"
```

(svn will ask for password multiple times).

You cannot commit new changes from the directory you just imported. You must check out the project in a new directory to make changes and commits to SVN:

Checkout:

From the /root directory:

```
svn co svn+ssh://pUNETID@zeus/home/pUNETID/SVNROOT/CS460_kbleds CS460_kbleds_svn
```

```
cd CS460_kbleds_svn
```

<edit files>

```
svn commit / svn update / svn add
```