ECS-150, Spring 2014, Programming Assignment #1

Due date: 11:59 p.m., April 18, 2014

Total 10% (1% penalty per 24 hours after the due date)

Modifying the FreeBSD 5.4 kernel and Loading new kernel modules

In this homework assignment, you will learn how to modify and compile a new FreeBSD kernel as well as how to utilize the "kld" (Kernel Loadable Module) interface to change the behavior of the kernel such as adding new system calls. Information regarding how to compile a FreeBSD kernel and how to program the KLD is available in the class website. During the discussion hours, the TA will also talk about kernel compilation and dynamically loadable kernel modules. **The TA will provide a test program as well.**

You must use the 5.4 kernel to do this and other kernel programming assignments, and you need to **submit all the kernel source code files you modify as well as the Makefile.** Please do NOT hand-in the whole source tree or any binary.

In this programming assignment, you will add two new attributes "`int tickets;`" and "`u_int64_t social_info;`" into "`struct proc {…};`" defined in "`/usr/src/sys/sys/proc.h`", and one global variable "`int lottery_mode;`" in "`/usr/src/sys/kern/kern_switch.c`". Then, you will add the following six system calls via the KLD interface:

```
int setProcessTickets(int pid, int tickets);
int getProcessTickets(int pid);
int setSocialInfo(int pid, u_int64_t social_info);
u_int64_t getSocialInfo(int pid);
int setLotteryMode(int mode);
int getLotteryMode(void);
```

The first two system calls will return an error code (-1) if the PID doesn't exist in the kernel. Please note that **you need to re-compile the kernel** in order to add the new attributes (tickets and social_info in struct proc) and the new global variable (lottery_mode), but you don't need to re-build the kernel to add new system calls.

Finally, in the development of this programming assignment, you will likely use the "printf" function call for debugging. Please find out the difference between calling printf in the user space and in kernel space (i.e., in the kernel module), and the instructor will ask you this as part of the midterm.

If you encounter any difficulty, please feel free to ask the instructor or the TA. Also, some useful links have been posted on our class **Facebook** group **"ecs150 Operating Systems @ UCDavis"**.