
Lab 3

Device Drivers

Driver Example Folders

The image shows a Linux desktop environment with a green background. On the left sidebar, there are icons for 'Computer', 'control's Home', 'Trash', 'Terminal', and 'CentOS_6.8_Final'. The main area contains two file manager windows and one terminal window.

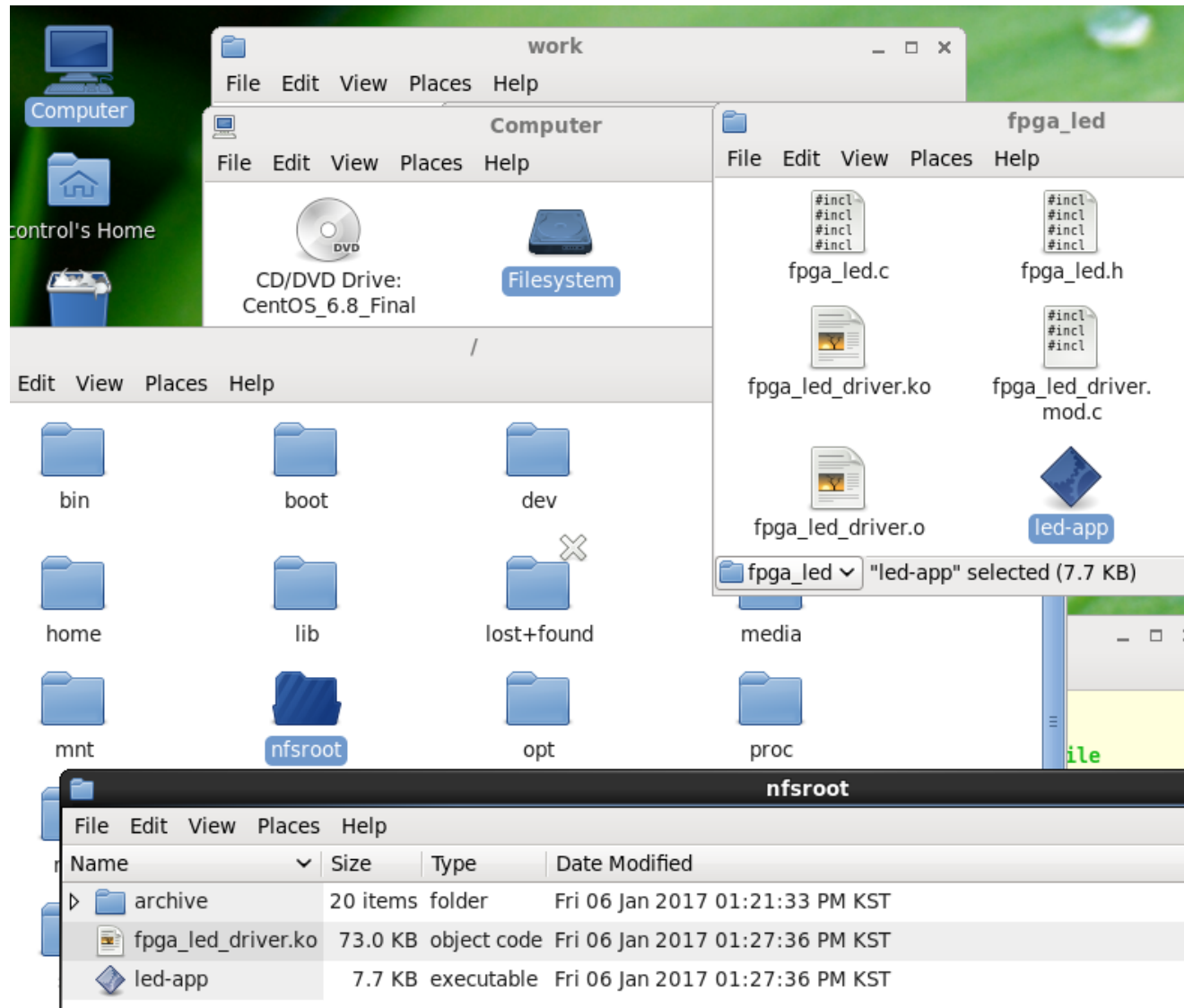
The top-left file manager window, titled 'work', shows a folder named 'driver' and a file named 'RiCpp_Linux.tar.gz'. The top-right file manager window, titled 'driver', shows six subfolders: 'fpga_clcd', 'fpga_fnd', 'fpga_int0', 'fpga_led', 'led_key', and 'ostimer'. The bottom terminal window shows the following commands and output:

```
control@localhost:~/work/driver
File Edit View Search Terminal Help
[control@localhost ~]$ cd work/driver
[control@localhost driver]$ ls
fpga_clcd  fpga_fnd  fpga_int0  fpga_led  led_key  ostimer
[control@localhost driver]$
```

Build

```
control@localhost:~/work/driver/fpga_led
File Edit View Search Terminal Help
[control@localhost driver]$ cd fpga_led
[control@localhost fpga_led]$ ls
fpga_led.c          fpga_led_driver.c~    fpga_led_driver.mod.o  Makefile
fpga_led.c~        fpga_led_driver.ko    fpga_led_driver.o      Makefile~
fpga_led_driver.c  fpga_led_driver.mod.c fpga_led.h
[control@localhost fpga_led]$ make clean
rm -rf *.ko
rm -rf *.mod.*
rm -rf *.o
rm -rf led-app
[control@localhost fpga_led]$ make
make -C /root/acumen/kernel/linux-2.6.12-a6 SUBDIRS=/home/control/work/driver/fpga_led modules
make[1]: Entering directory `/root/acumen/kernel/linux-2.6.12-a6'
  CC [M] /home/control/work/driver/fpga_led/fpga_led_driver.o
/home/control/work/driver/fpga_led/fpga_led_driver.c:40: warning: initialization
from incompatible pointer type
  Building modules, stage 2.
  MODPOST
  CC /home/control/work/driver/fpga_led/fpga_led_driver.mod.o
  LD [M] /home/control/work/driver/fpga_led/fpga_led_driver.ko
make[1]: Leaving directory `/root/acumen/kernel/linux-2.6.12-a6'
arm-linux-gcc -o led-app fpga_led.c
[control@localhost fpga_led]$
```

Copy Files to /nsfroot



Target Console

```
insmod fpga_led_driver.ko  
mknod /dev/fpga_led c 242 0  
./led-app
```

```
[root@Linux /]#mount -t nfs 192.168.0.68:/nfsroot /mnt/nfs -o nolock -o rsize=1024  
nfs warning: mount version older than kernel  
[root@Linux /]#cd /mnt/nfs  
[root@Linux nfs]#ls  
archive          fpga_led_driver.ko  led-app  
[root@Linux nfs]#insmod fpga_led_driver.ko  
Using fpga_led_driver.ko  
init module, fpga_led major number: 242  
[root@Linux nfs]#mknod /dev/fpga_led c 242 0  
[root@Linux nfs]#./led-app  
  
led_test  
stop = Ctrl+C  
  
[root@Linux nfs]#
```

Exercise 1

- 다음 폴더의 예제들을 실행해서 동작을 확인하십시오.
 - fpga_clcd
 - fpga_fnd

Exercise 2

- 프로그램이 시작되면 **standard console**에서 영어 문자열 입력을 기다린다.
- **Standard console**에 임의의 영어 문자열을 입력하면 그 문자열을 **character LCD**에 나타낸다
- 문자열을 나타낸 후 다시 입력을 기다린다.
- 반드시 두 개의 **thread**를 사용한다. 한 개의 **thread**는 영어 문자열 입력을 받고, 그 문자열을 다른 **thread**에 보낸다. 그러면 문자열을 받은 **thread**는 그 문자열을 **character LCD**에 나타낸다.