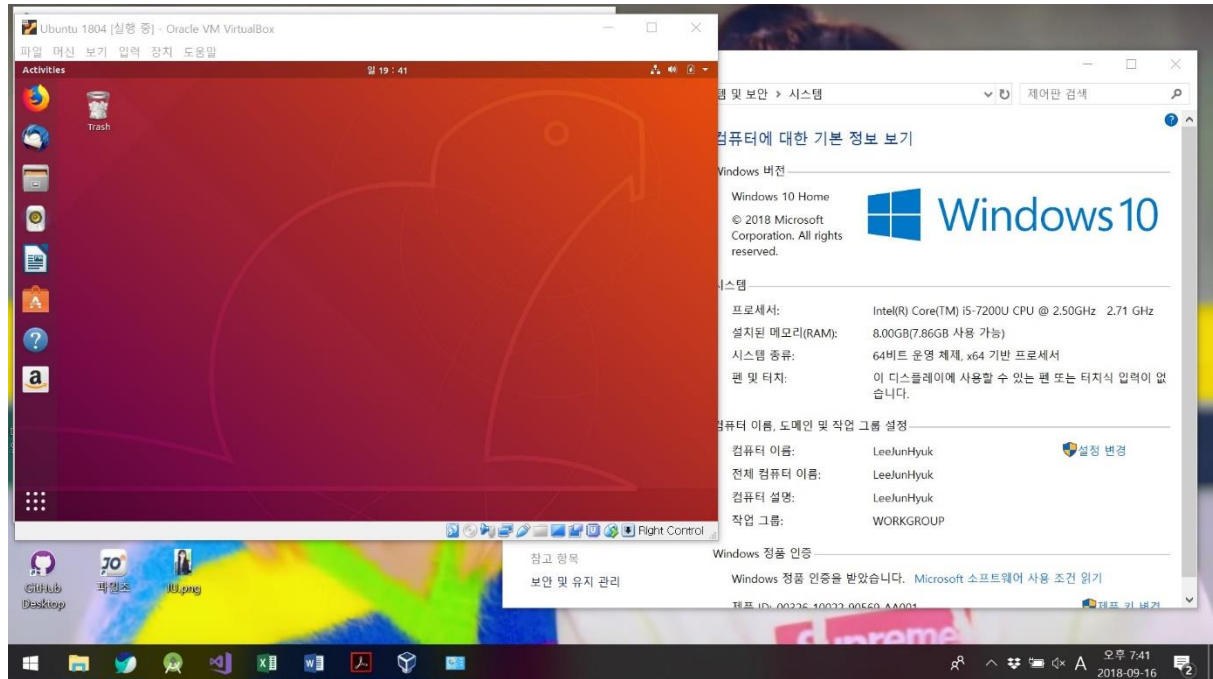


Operating Systems
Fall 2018
Hw No. 1

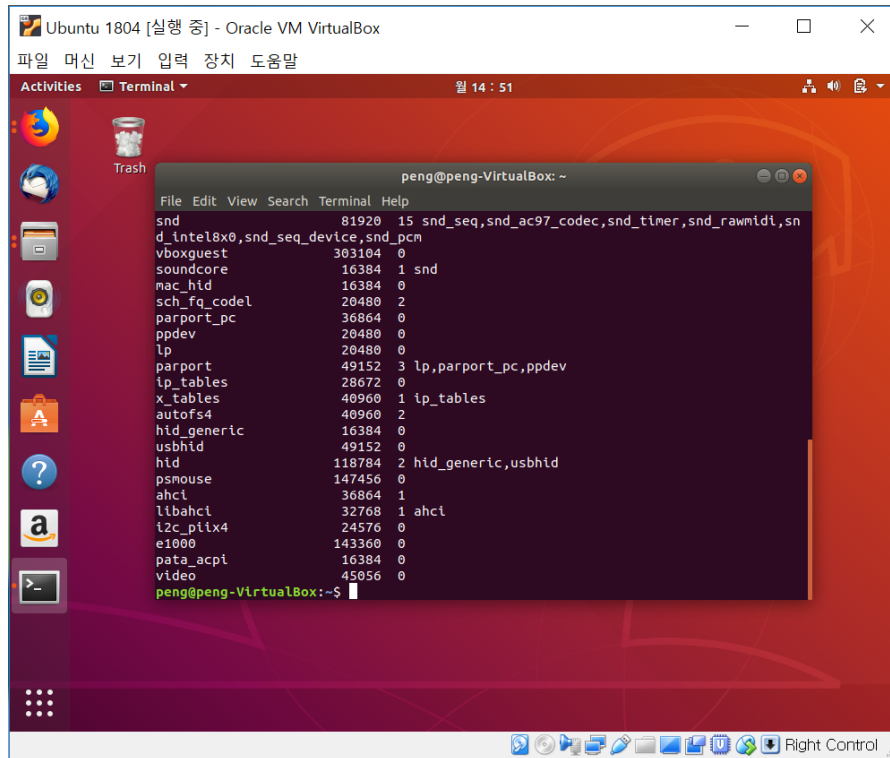
(Due on Sept. 20)

ID / NAME : 2014310407 / 이준혁(Lee JunHyuk)

1. Install Linux Virtual Machine in your PC. As a proof, show its screen shot. (50)



2. Read the programming project on Linux kernel module in the textbook p. 94 – p. 96, Part I. Do the Part I Assignment in p. 96, and report the screen shot of the result of each step. (50)



Ubuntu 1804 [실행 중] - Oracle VM VirtualBox

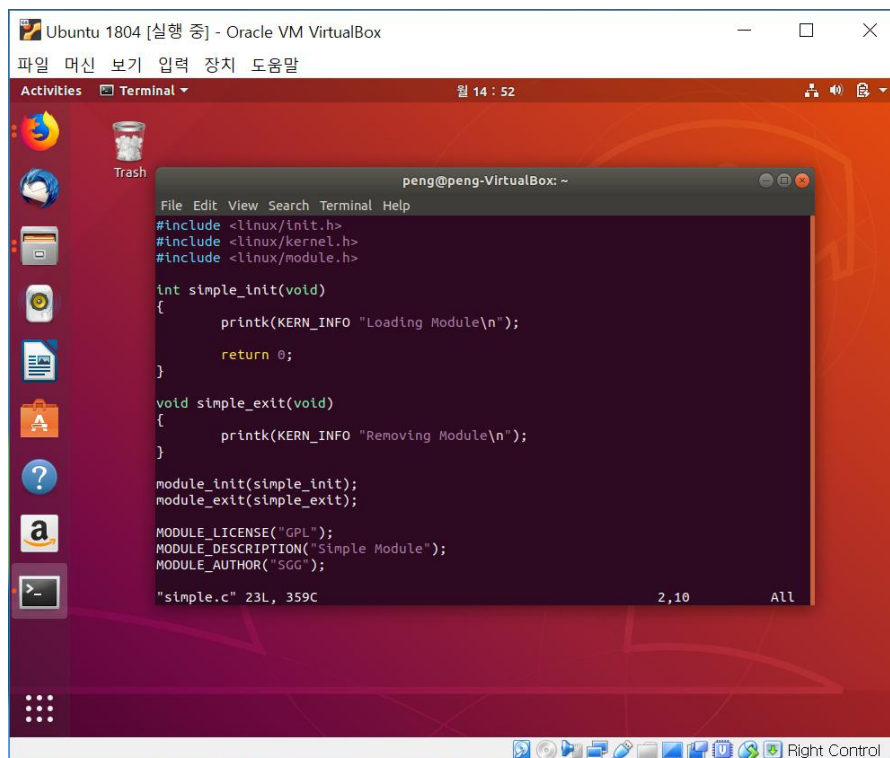
파일 머신 보기 입력 장치 도움말

Activities Terminal 월 14 : 51

peng@peng-VirtualBox: ~

```
File Edit View Search Terminal Help
snd                81920  15 snd_seq,snd_ac97_codec,snd_timer,snd_rawmidi,snd
d_intel8x0,snd_seq_device,snd_pcm
vboxguest          303104  0
soundcore           16384  1 snd
mac_hid             16384  0
sch_fq_codel        20480  2
parport_pc          36864  0
ppdev               20480  0
lp                  20480  0
parport             49152  3 lp,parport_pc,ppdev
lp_tables           28672  0
x_tables            40960  1 lp_tables
autofs4             40960  2
hid_generic         16384  0
usbhid              49152  0
hid                 118784  2 hid_generic,usbhid
psmouse             147456  0
ahci                 36864  1
libahci             32768  1 ahci
i2c_piix4           24576  0
e1000               143360  0
pata_acpi           16384  0
video               45056  0
peng@peng-VirtualBox:~$
```

1) List all kernel modules using lsmod



Ubuntu 1804 [실행 중] - Oracle VM VirtualBox

파일 머신 보기 입력 장치 도움말

Activities Terminal 월 14 : 52

peng@peng-VirtualBox: ~

```
File Edit View Search Terminal Help
#include <linux/init.h>
#include <linux/kernel.h>
#include <linux/module.h>

int simple_init(void)
{
    printk(KERN_INFO "Loading Module\n");
    return 0;
}

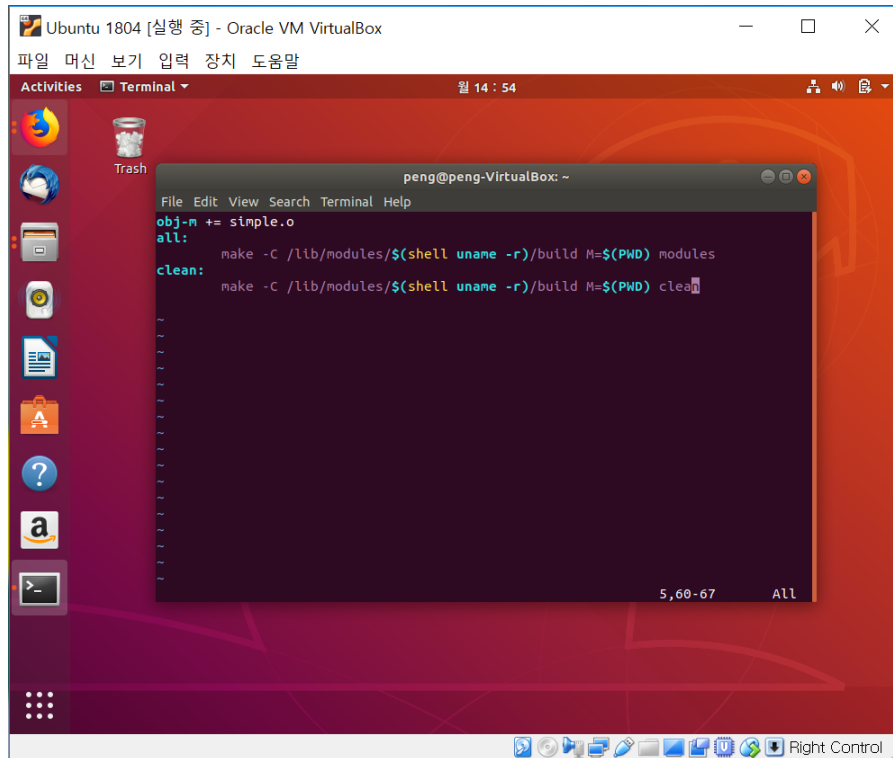
void simple_exit(void)
{
    printk(KERN_INFO "Removing Module\n");
}

module_init(simple_init);
module_exit(simple_exit);

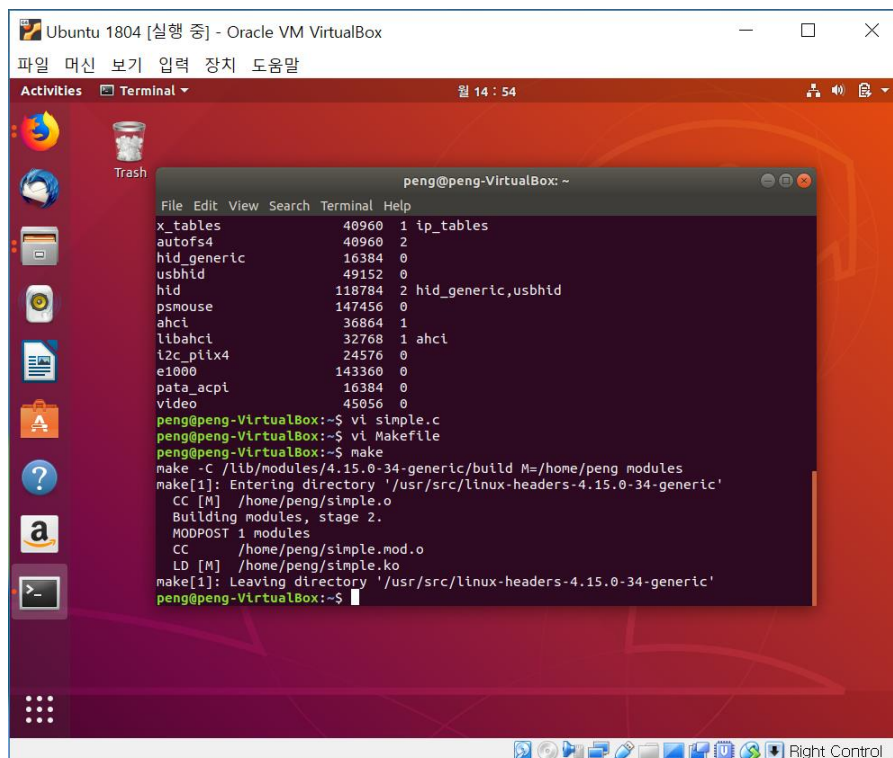
MODULE_LICENSE("GPL");
MODULE_DESCRIPTION("Simple Module");
MODULE_AUTHOR("SGG");

"simple.c" 23L, 359C      2,10  All
```

2) Writes a simple.c



3) Writes a Makefile



4) Compile using Makefile

Ubuntu 1804 [실행 중] - Oracle VM VirtualBox

파일 머신 보기 입력 장치 도움말

Activities Terminal 월 14 : 57

```
peng@peng-VirtualBox: ~  
File Edit View Search Terminal Help  
x_tables 40960 1 ip_tables  
autofs4 40960 2  
hid_generic 16384 0  
usbhid 49152 0  
hid 118784 2 hid_generic,usbhid  
psmouse 147456 0  
ahci 36864 1  
libahci 32768 1 ahci  
i2c_piix4 24576 0  
e1000 143360 0  
pata_acpi 16384 0  
video 45056 0  
peng@peng-VirtualBox:~$ vi simple.c  
peng@peng-VirtualBox:~$ vi Makefile  
peng@peng-VirtualBox:~$ make  
make -C /lib/modules/4.15.0-34-generic/build M=/home/peng modules  
make[1]: Entering directory '/usr/src/linux-headers-4.15.0-34-generic'  
CC [M] /home/peng/simple.o  
Building modules, stage 2.  
MODPOST 1 modules  
CC /home/peng/simple.mod.o  
LD [M] /home/peng/simple.ko  
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-34-generic'  
peng@peng-VirtualBox:~$ sudo insmod simple.ko
```

5) Load the kernel module

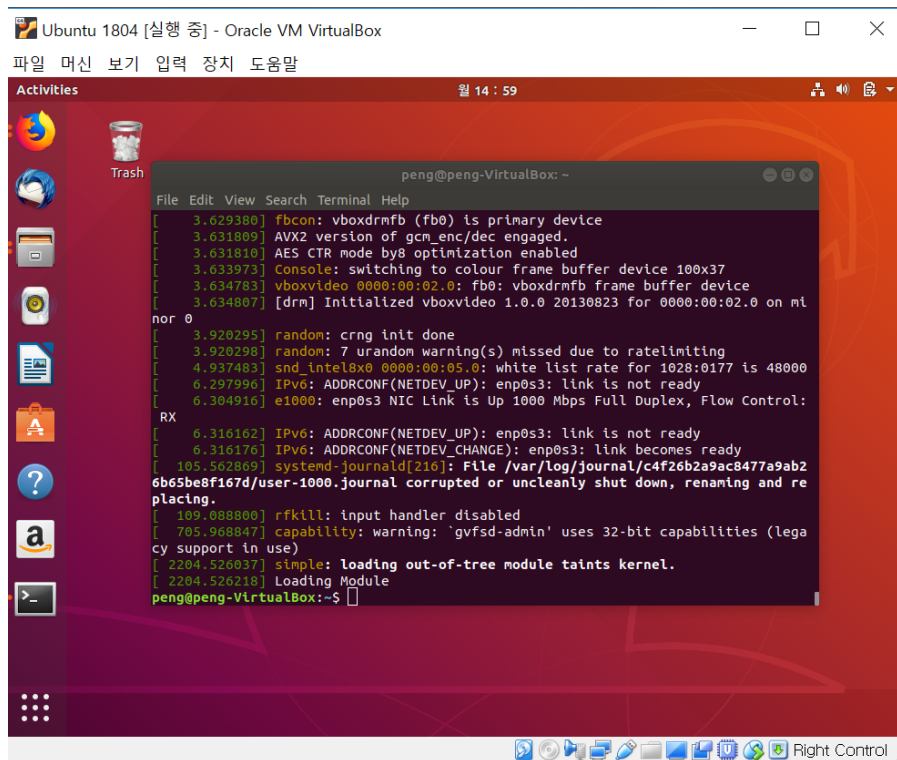
Ubuntu 1804 [실행 중] - Oracle VM VirtualBox

파일 머신 보기 입력 장치 도움말

Activities Terminal 월 14 : 58

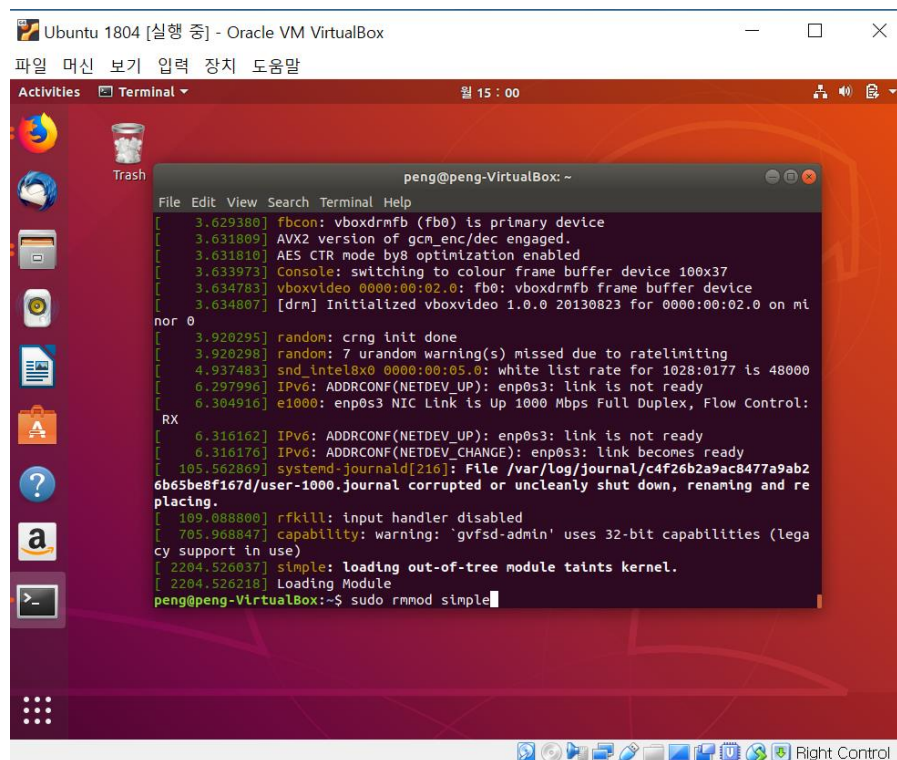
```
peng@peng-VirtualBox: ~  
File Edit View Search Terminal Help  
libahci 32768 1 ahci  
i2c_piix4 24576 0  
e1000 143360 0  
pata_acpi 16384 0  
video 45056 0  
peng@peng-VirtualBox:~$ vi simple.c  
peng@peng-VirtualBox:~$ vi Makefile  
peng@peng-VirtualBox:~$ make  
make -C /lib/modules/4.15.0-34-generic/build M=/home/peng modules  
make[1]: Entering directory '/usr/src/linux-headers-4.15.0-34-generic'  
CC [M] /home/peng/simple.o  
Building modules, stage 2.  
MODPOST 1 modules  
CC /home/peng/simple.mod.o  
LD [M] /home/peng/simple.ko  
make[1]: Leaving directory '/usr/src/linux-headers-4.15.0-34-generic'  
peng@peng-VirtualBox:~$ sudo insmod simple.ko  
[sudo] password for peng:  
peng@peng-VirtualBox:~$ lsmod  
Module Size Used by  
simple 16384 0  
intel_powerclamp 16384 0  
crct10dif_pclmul 16384 0  
crc32_pclmul 16384 0
```

6) Using lsmod, check the simple module exist



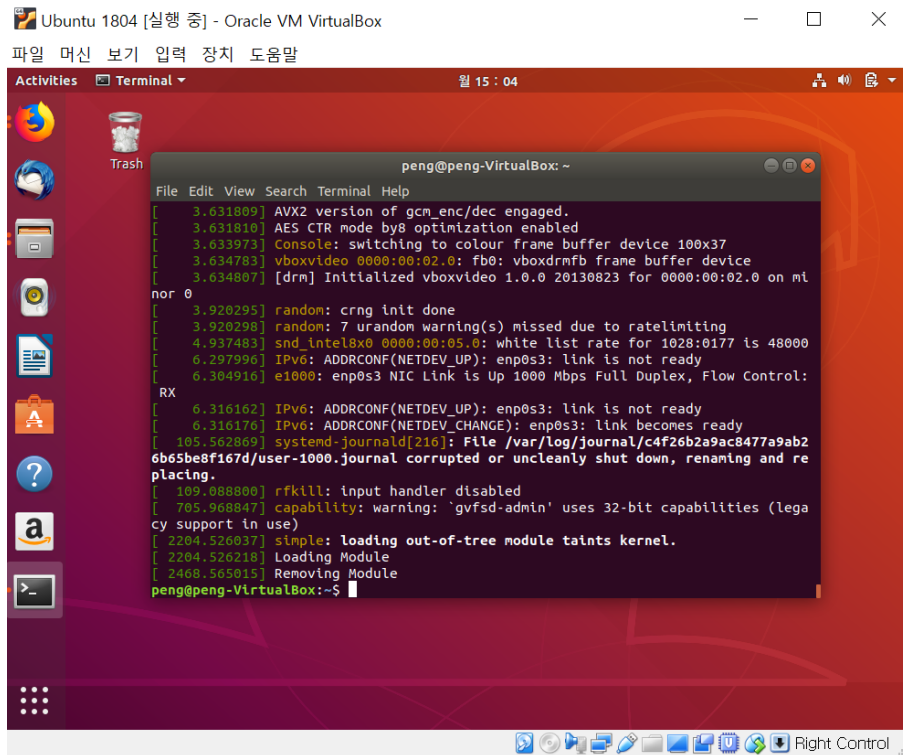
```
peng@peng-VirtualBox: ~  
[ 3.629380] fbcon: vboxdrmfb (fb0) is primary device  
[ 3.631809] AVX2 version of gcm_enc/dec engaged.  
[ 3.631810] AES CTR mode by8 optimization enabled  
[ 3.633973] Console: switching to colour frame buffer device 100x37  
[ 3.634783] vboxvideo 0000:00:02.0: fb0: vboxdrmfb frame buffer device  
[ 3.634807] [drm] Initialized vboxvideo 1.0.0 20130823 for 0000:00:02.0 on m  
nor 0  
[ 3.920295] random: crng init done  
[ 3.920298] random: 7 urandom warning(s) missed due to ratelimiting  
[ 4.937483] snd_intel8x0 0000:00:05.0: white list rate for 1028:0177 is 48000  
[ 6.297996] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.304916] e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control:  
RX  
[ 6.316162] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.316176] IPv6: ADDRCONF(NETDEV_CHANGE): enp0s3: link becomes ready  
[ 105.562869] systemd-journald[216]: File /var/log/journal/c4f26b2a9ac8477a9ab2  
6b65be8f167d/user-1000.journal corrupted or uncleanly shut down, renaming and re  
placing.  
[ 109.088800] rfkill: input handler disabled  
[ 705.968847] capability: warning: 'gvfsd-admin' uses 32-bit capabilities (lega  
cy support in use)  
[ 2204.526037] simple: loading out-of-tree module taints kernel.  
[ 2204.526218] Loading Module  
peng@peng-VirtualBox:~$
```

7) Using dmseg, check the kernel log buffer



```
peng@peng-VirtualBox: ~  
[ 3.629380] fbcon: vboxdrmfb (fb0) is primary device  
[ 3.631809] AVX2 version of gcm_enc/dec engaged.  
[ 3.631810] AES CTR mode by8 optimization enabled  
[ 3.633973] Console: switching to colour frame buffer device 100x37  
[ 3.634783] vboxvideo 0000:00:02.0: fb0: vboxdrmfb frame buffer device  
[ 3.634807] [drm] Initialized vboxvideo 1.0.0 20130823 for 0000:00:02.0 on m  
nor 0  
[ 3.920295] random: crng init done  
[ 3.920298] random: 7 urandom warning(s) missed due to ratelimiting  
[ 4.937483] snd_intel8x0 0000:00:05.0: white list rate for 1028:0177 is 48000  
[ 6.297996] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.304916] e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control:  
RX  
[ 6.316162] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.316176] IPv6: ADDRCONF(NETDEV_CHANGE): enp0s3: link becomes ready  
[ 105.562869] systemd-journald[216]: File /var/log/journal/c4f26b2a9ac8477a9ab2  
6b65be8f167d/user-1000.journal corrupted or uncleanly shut down, renaming and re  
placing.  
[ 109.088800] rfkill: input handler disabled  
[ 705.968847] capability: warning: 'gvfsd-admin' uses 32-bit capabilities (lega  
cy support in use)  
[ 2204.526037] simple: loading out-of-tree module taints kernel.  
[ 2204.526218] Loading Module  
peng@peng-VirtualBox:~$ sudo rmmod simple
```

8) Remove the kernel module



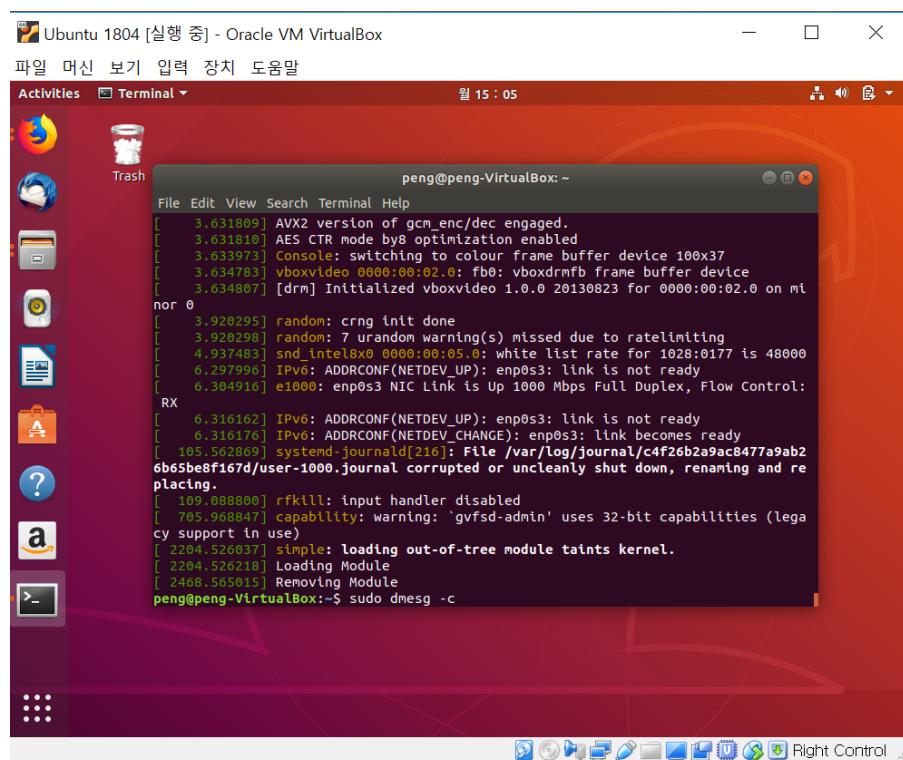
Ubuntu 1804 [실행 중] - Oracle VM VirtualBox

파일 머신 보기 입력 장치 도움말

Activities Terminal 월 15 : 04

```
peng@peng-VirtualBox: ~  
File Edit View Search Terminal Help  
[ 3.631809] AVX2 version of gcm_enc/dec engaged.  
[ 3.631810] AES CTR mode by8 optimization enabled  
[ 3.633973] Console: switching to colour frame buffer device 100x37  
[ 3.634783] vboxvideo 0000:00:02.0: fb0: vboxdrmfb frame buffer device  
[ 3.634807] [drm] Initialized vboxvideo 1.0.0 20130823 for 0000:00:02.0 on m  
nor 0  
[ 3.920295] random: crng init done  
[ 3.920298] random: 7 urandom warning(s) missed due to ratelimiting  
[ 4.937483] snd_intel8x0 0000:00:05.0: white list rate for 1028:0177 is 48000  
[ 6.297996] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.304916] e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control:  
RX  
[ 6.316162] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.316176] IPv6: ADDRCONF(NETDEV_CHANGE): enp0s3: link becomes ready  
[ 105.562869] systemd-journald[216]: File /var/log/journal/c4f26b2a9ac8477a9ab2  
6b65be8f167d/user-1000.journal corrupted or uncleanly shut down, renaming and re  
placing.  
[ 109.088800] rfkill: input handler disabled  
[ 705.968847] capability: warning: 'gvfsd-admin' uses 32-bit capabilities (lega  
cy support in use)  
[ 2204.526037] simple: loading out-of-tree module taints kernel.  
[ 2204.526218] Loading Module  
[ 2468.565015] Removing Module  
peng@peng-VirtualBox:~$
```

9) Using dmseg, check the kernel log buffer



Ubuntu 1804 [실행 중] - Oracle VM VirtualBox

파일 머신 보기 입력 장치 도움말

Activities Terminal 월 15 : 05

```
peng@peng-VirtualBox: ~  
File Edit View Search Terminal Help  
[ 3.631809] AVX2 version of gcm_enc/dec engaged.  
[ 3.631810] AES CTR mode by8 optimization enabled  
[ 3.633973] Console: switching to colour frame buffer device 100x37  
[ 3.634783] vboxvideo 0000:00:02.0: fb0: vboxdrmfb frame buffer device  
[ 3.634807] [drm] Initialized vboxvideo 1.0.0 20130823 for 0000:00:02.0 on m  
nor 0  
[ 3.920295] random: crng init done  
[ 3.920298] random: 7 urandom warning(s) missed due to ratelimiting  
[ 4.937483] snd_intel8x0 0000:00:05.0: white list rate for 1028:0177 is 48000  
[ 6.297996] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.304916] e1000: enp0s3 NIC Link is Up 1000 Mbps Full Duplex, Flow Control:  
RX  
[ 6.316162] IPv6: ADDRCONF(NETDEV_UP): enp0s3: link is not ready  
[ 6.316176] IPv6: ADDRCONF(NETDEV_CHANGE): enp0s3: link becomes ready  
[ 105.562869] systemd-journald[216]: File /var/log/journal/c4f26b2a9ac8477a9ab2  
6b65be8f167d/user-1000.journal corrupted or uncleanly shut down, renaming and re  
placing.  
[ 109.088800] rfkill: input handler disabled  
[ 705.968847] capability: warning: 'gvfsd-admin' uses 32-bit capabilities (lega  
cy support in use)  
[ 2204.526037] simple: loading out-of-tree module taints kernel.  
[ 2204.526218] Loading Module  
[ 2468.565015] Removing Module  
peng@peng-VirtualBox:~$ sudo dmesg -c
```

10) clear the kernel log buffer