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Project Phase 2

Operating Systems
Spring 2017

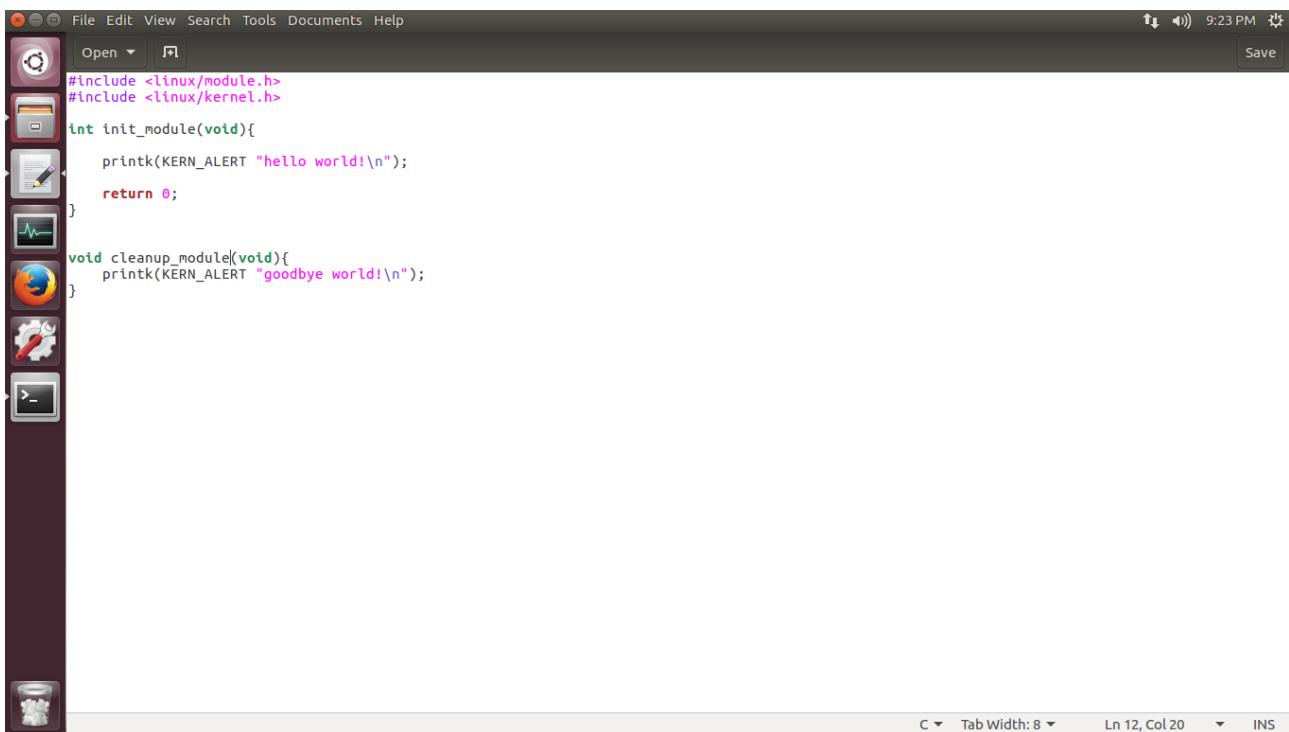
Part 1

Implementation of Simple “hello world” Module and Run

Every module structure have two major functions:

1. init
 - executed when the module is loaded into kernel
2. cleanup
 - executed when the module is removed from kernel

the simple module implementation is here:



A screenshot of a code editor window titled "Untitled" showing a simple Linux module implementation. The code includes #include directives for linux/module.h and linux/kernel.h, an init_module function that prints "hello world!\n" to the kernel log, and a cleanup_module function that prints "goodbye world!\n". The code editor interface includes a toolbar with icons for file operations, a status bar at the bottom showing tabs, width, and line/col numbers, and a menu bar with File, Edit, View, Search, Tools, Documents, Help, and a timestamp of 9:23 PM.

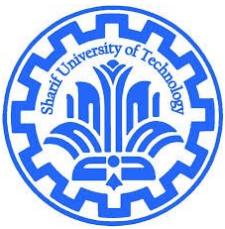
```
#include <linux/module.h>
#include <linux/kernel.h>

int init_module(void){
    printk(KERN_ALERT "hello world!\n");
    return 0;
}

void cleanup_module(void){
    printk(KERN_ALERT "goodbye world!\n");
}
```

notes:

module.h is for the module itself

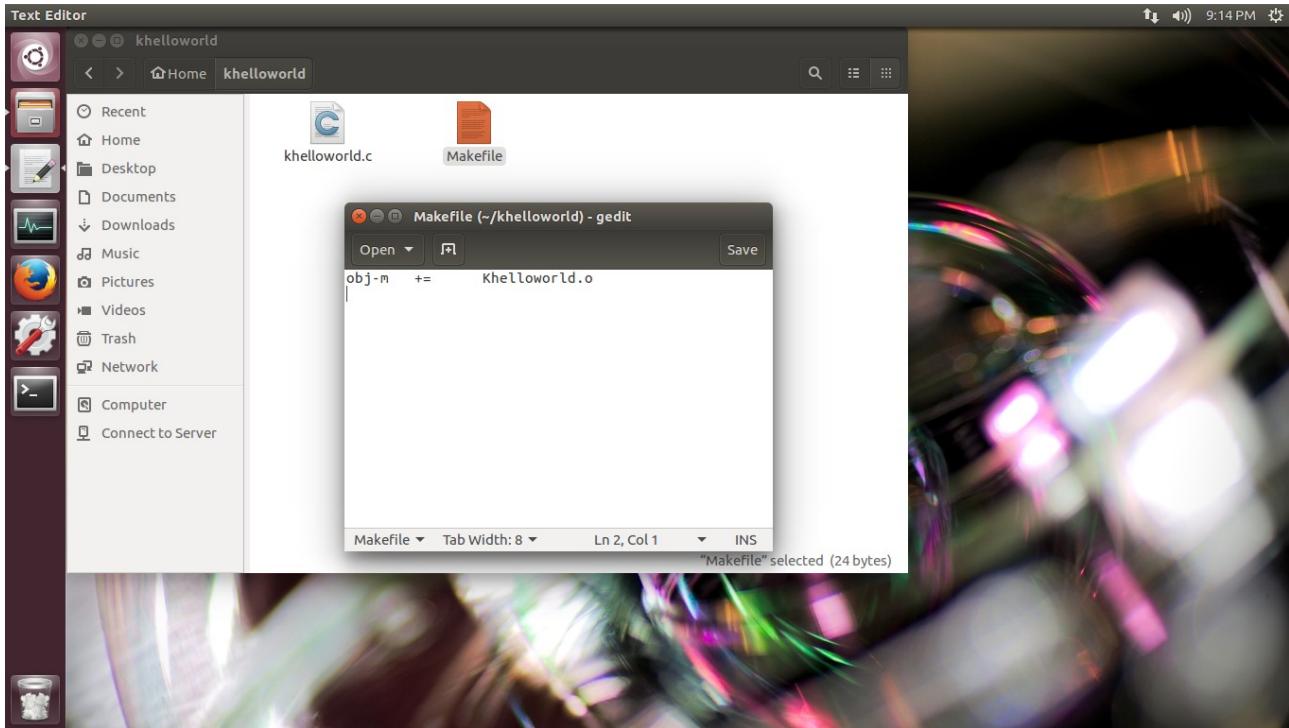


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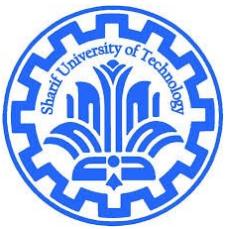
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kernel.h is for the KERN_ALERT

the make file for this module:

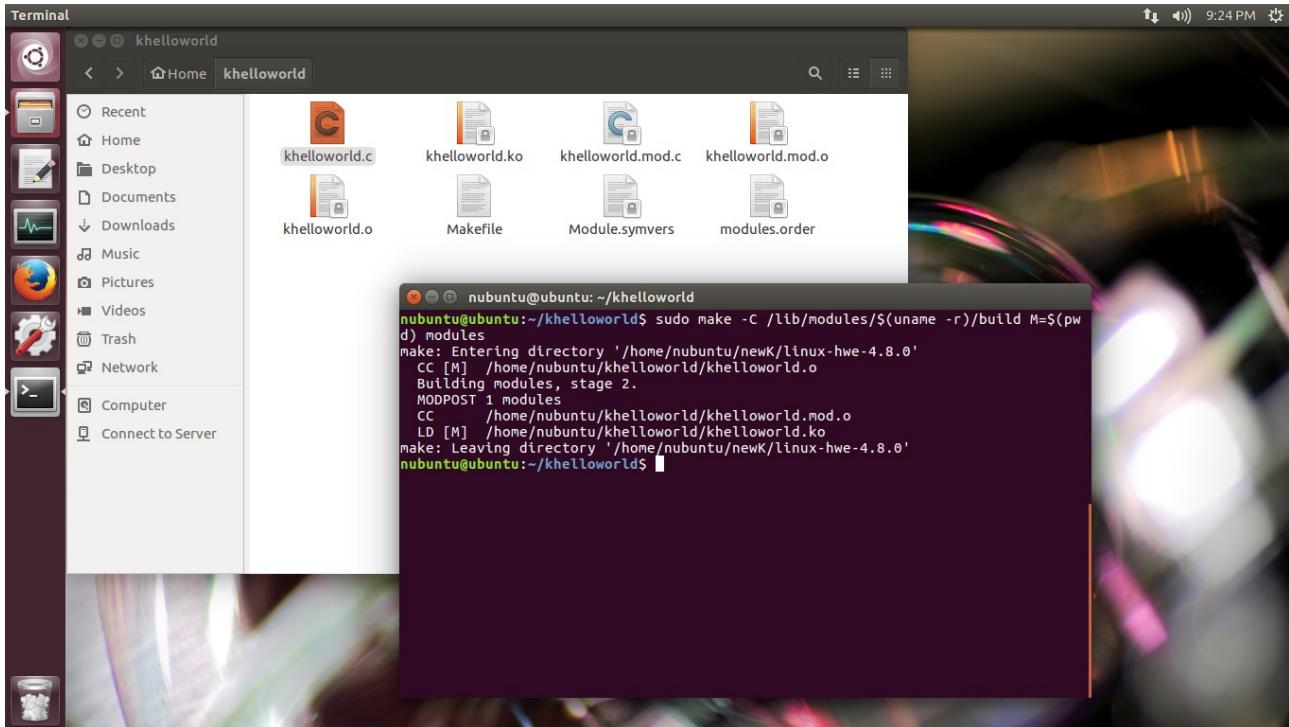


now lets compile the module:

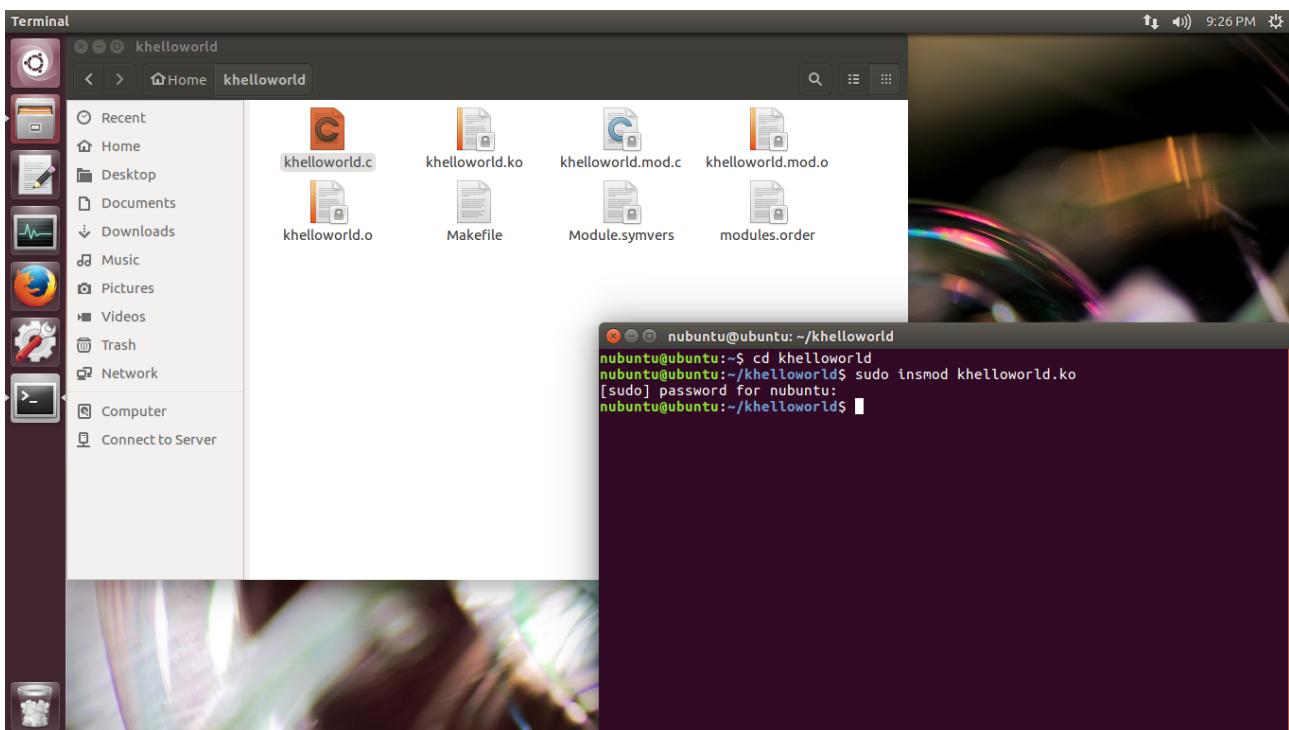


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install the module:





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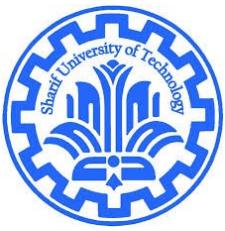
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now checking the dmesg:

The screenshot shows a desktop environment with a file browser window titled 'khelloworld' open. Inside the browser, there are several files: khelloworld.c, khelloworld.ko, khelloworld.mod.c, khelloworld.mod.o, khelloworld.o, Makefile, Module.symvers, and modules.order. Below the browser is a terminal window with the command 'dmesg' running. The terminal output shows kernel messages, including audit logs, network configuration changes, and module loading information. One notable message is 'khelloworld: loading out-of-tree module taints kernel.' followed by 'Disabling lock debugging due to kernel taint'.

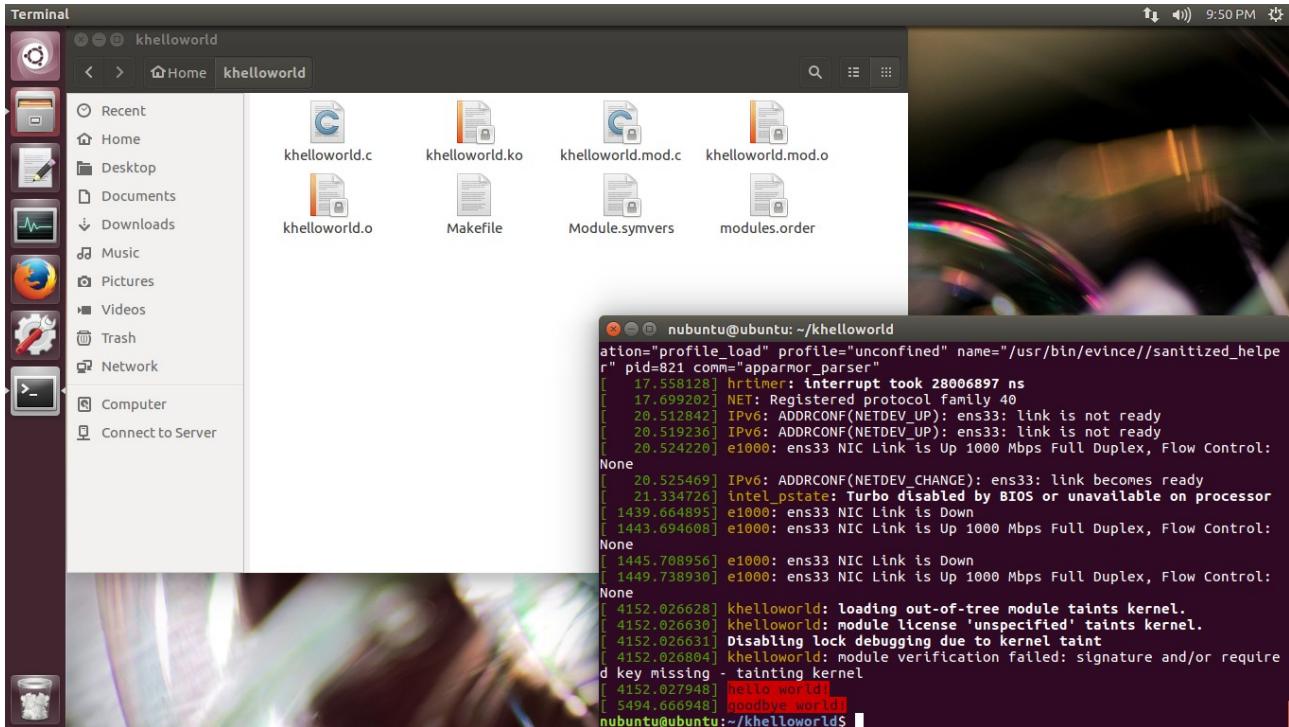
```
[ 7.686739] audit: type=1400 audit(1497410210.944:11): apparmor="STATUS" operation="profile_load" profile="unconfined" name="/usr/bin/evince//sanitized_HELPER" pid=821 comm="apparmor_parser"
[ 17.558128] hrtimer: interrupt took 28006897 ns
[ 17.699202] NET: Registered protocol family 40
[ 20.512842] IPv6: ADDRCONF(NETDEV_UP): ens33: link is not ready
[ 20.519236] IPv6: ADDRCONF(NETDEV_UP): ens33: link is not ready
[ 20.524220] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 20.525469] IPv6: ADDRCONF(NETDEV_CHANGE): ens33: link becomes ready
[ 21.334726] intel_pstate: Turbo disabled by BIOS or unavailable on processor
[ 1439.664895] e1000: ens33 NIC Link is Down
[ 1443.094008] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 1445.708956] e1000: ens33 NIC Link is Down
[ 1449.738930] e1000: ens33 NIC Link is Up 1000 Mbps Full Duplex, Flow Control: None
[ 4152.026628] khelloworld: loading out-of-tree module taints kernel.
[ 4152.026630] khelloworld: module license 'unspecified' taints kernel.
[ 4152.026631] Disabling lock debugging due to kernel taint
[ 4152.026804] khelloworld: module verification failed: signature and/or required key missing - tainting kernel
[ 4152.027948] hello world!
```

now you can remove the module with `sudo rmmod khelloworld.ko` and check dmesg:



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End of part one