

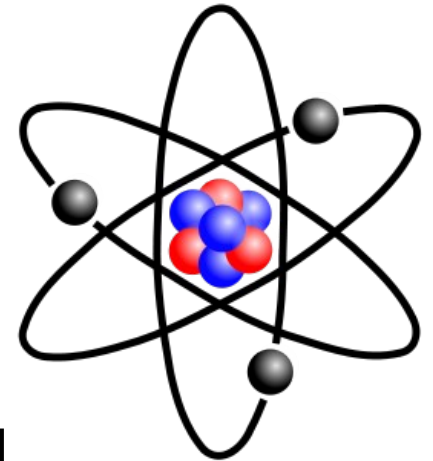
Driver Basics



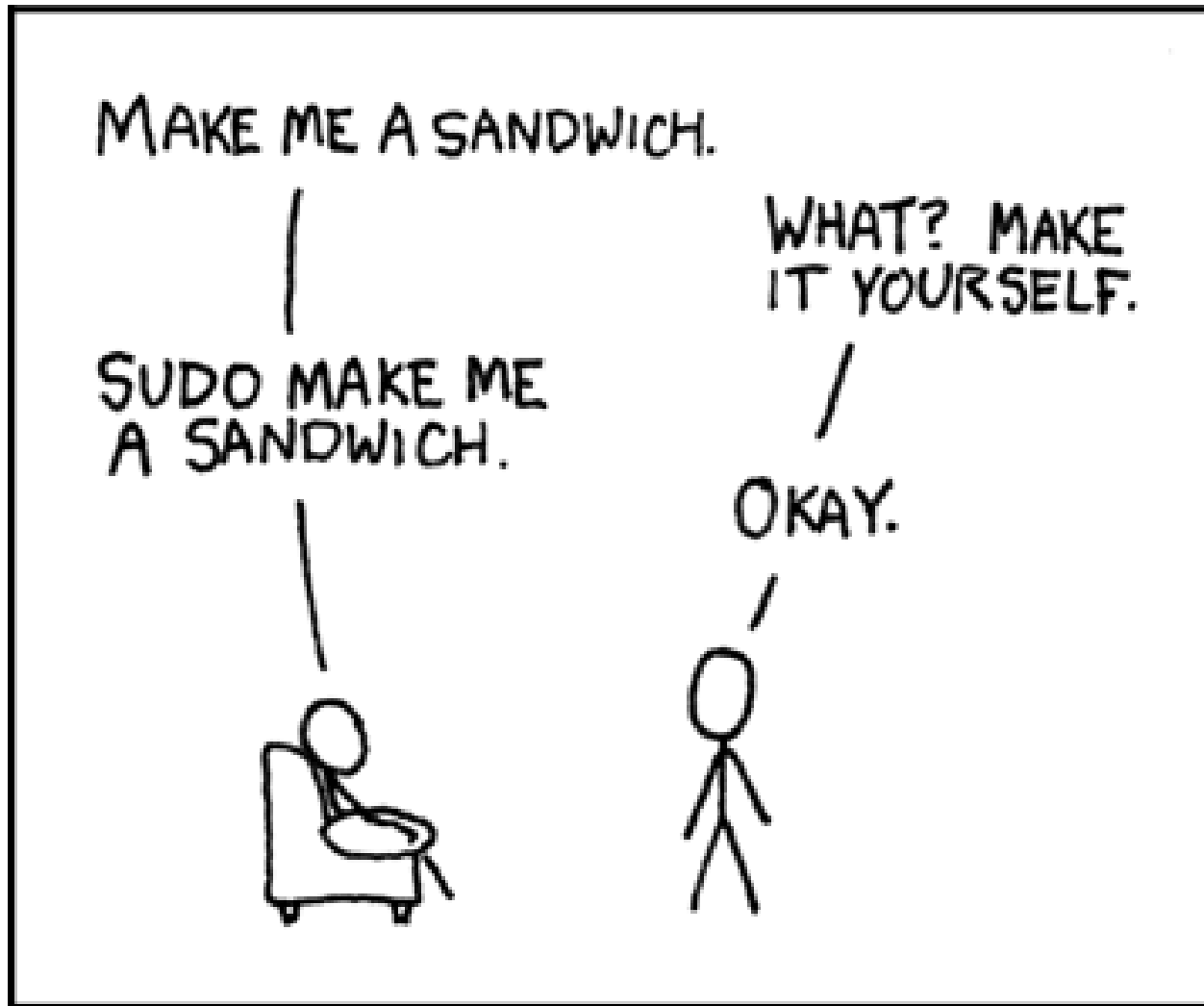
Getting our hands dirty
ECE 373

Fun with Atoms

- Serial link to Atom box
 - Null modem serial cable
 - Putty and minicom
- Screen capture and session logging
 - Putty and minicom logs
 - Script command



Running as root



File Sharing – USB memory

- GUI goodness
 - Ubuntu GUI automounts USB
 - /media/<volume-name>
- Do-it-yourself
 - mkdir /media/usb
 - Plug in USB drive
 - Look for /dev/sdX in /var/log/messages
 - mount /dev/sdX /media/usb
 - umount /dev/sdX



Virtual Machines

- "Serial" link to machine
 - Connects to a COM port
 - Also putty and minicom
- Also screen capture and session logging
- Emulates full computer inside of a "bare metal" machine
- Can load different "hardware" to emulate behavior
- Can direct-assign hardware into a VM as well

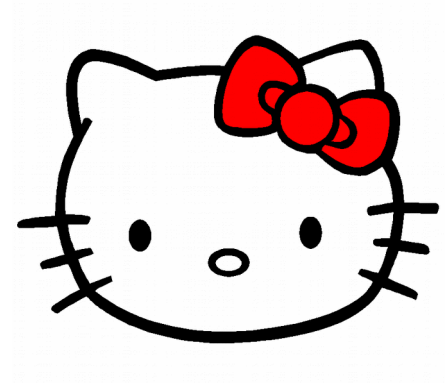
Hello Kernel

```
#include <linux/init.h>
#include <linux/module.h>
MODULE_LICENSE("Dual BSD/GPL");

static int __init hello_init(void)
{
    printk(KERN_INFO "Hello, kernel\n");
    return 0;
}

static void __exit hello_exit(void)
{
    printk(KERN_INFO "Goodbye, kernel\n");
}

module_init(hello_init);
module_exit(hello_exit);
```



Plug-In APIs

- Application Programming Interface
- Defines "hooks" on which to hang your driver
- Standard programming connections



Bits and pieces

- Standard API for all driver modules
- Minimal callback hooks and Compile headers
 - Basic #includes
 - MODULE_LICENSE(lic) – legal strings
 - __init, __exit
 - module_init(func)
 - module_exit(func)
- Printk and KERN_xxx
- Kernel Makefile convolutions
- Compile command

Makefile

Makefile

```
KERNEL_DIR = /lib/modules/$(shell uname -r)/build  
PWD := $(shell pwd)
```

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

```
default:
```

```
    $(MAKE) -C $(KERNEL_DIR) SUBDIRS=$(PWD) modules
```

```
clean:
```

```
    $(MAKE) -C $(KERNEL_DIR) SUBDIRS=$(PWD) clean
```



Tabs, not spaces

Try it out

- **Compile:** `make`
- **Load:** `insmod hello_kernel.ko`
- **Results**
 - `lsmod`
 - `dmesg` – more detailed, but limited circular buffer
 - `tail /var/log/syslog` – managed syslog text file, not as much detail
 - `journalctl` – for your systemd overlords
- **Remove:** `rmmod hello_kernel`

