CS134
Advanced
Operating Systems

Emulab

Slide 1

What is Emulab?

- Several hundred machines at U of Utah
- Anybody can get accounts
- Allows root hacking

Slide 2

Quick Overview

- `www.emulab.net` — Web interface
  - Set up & manage accounts
  - Set up "experiment" (get a PC)
  - End experiments
- `users.emulab.net` — SSH interface
  - Access console of PC you got

Slide 3

Getting Going

- Bring up `www.emulab.net`
- Click **Join Project**
  - Title is "student"
  - Affiliation is "Harvey Mudd College"
  - SSH key is optional (but makes your life easier)
  - Project name is `HMC_CS134`
  - I will approve you & you'll get e-mail

Slide 4

Doing a Project on Emulab

- Log in via Web interface
- Get a machine
- Log in to `ssh` interface
- Access machine and do project
- Use Web interface to terminate yourself

Slide 5

Getting a Machine

- Click **Begin Experiment**
- Default everything except project
- NS file is `/proj/HMC_CS134/onemachine.ns`
- Click **realtime** to find out node name

Slide 6

CS134

Getting Access

- `ssh` to `users.emulab.net`
- Type "`tip pc`*nnn*" where `nnn` is given in **realtime** output
- Log in as yourself
- Get out of `tip` later with `~~.`
  - ▷ Be sure to double the tilde!

Slide 7

CS134

Doing Experiments

- Create (or upload) `Makefile`, sources
- Compile
- Use "`sudo insmod` *x*" to try your module

Slide 8

Finishing Up

- Get out of `tip` with `~~.`
  - Or just terminate ssh session
- Click **Experiment Information** in Web interface
- Click on name of your experiment (EID)
- Click **Terminate this experiment** and confirm

Slide 9

Sample Module Makefile

```
CFLAGS = -c -Wall -D__KERNEL__ -DMODULE

all:    trivmodule.o
```

Slide 10

Sample Module

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

int init_module()
{
    printk(KERN_EMERG "CS134 sample module initialized\n");
    /* Return negative error code (e.g., -EBUSY) on error */
    return 0;
}

int cleanup_module()
{
    printk(KERN_EMERG "CS134 sample module cleaned up\n");
    /* Return negative error code (e.g., -EBUSY) on error */
    return 0;
}
```

Slide 11

Sample Run (1)

```
Script started on Thu Apr  4 12:06:21 2002
[geoff@NodeA modules-sample]$ /bin/rm trivmodule.o
[geoff@NodeA modules-sample]$ make
cc -c -Wall -D__KERNEL__ -DMODULE   -c -o trivmodule.o trivmodule.c
[geoff@NodeA modules-sample]$ sudo insmod trivmodule.o
[geoff@NodeA modules-sample]$ cat /proc/modules
trivmodule               480   0 (unused)
w83781d                16992   0 (unused)
sensors                 6384   0 [w83781d]
i2c-piix4               4128   0 (unused)
i2c-core               12864   0 [w83781d sensors i2c-piix4]
autofs                 10912   1 (autoclean)
ipchains               35424   0 (unused)
md                     59968   0 (unused)
[geoff@NodeA modules-sample]$ lsmod
Module                  Size  Used by
trivmodule               480   0 (unused)
w83781d                16992   0 (unused)
sensors                 6384   0 [w83781d]
i2c-piix4               4128   0 (unused)
i2c-core               12864   0 [w83781d sensors i2c-piix4]
autofs                 10912   1 (autoclean)
ipchains               35424   0 (unused)
md                     59968   0 (unused)
[geoff@NodeA modules-sample]$ sudo rmmod trivmodule
```

Slide 12

Sample Run (2)

```
[geoff@NodeA modules-sample]$ sudo tail /var/log/messages
Apr  4 11:59:17 pc3 healthd: A value of -10.22 for CPU #1 Core Voltage with a range of (1.95 <= n <= 2.05)
Apr  4 11:59:17 pc3 healthd: A value of 3.55 for 3.3 Volt with a range of (3.14 <= n <= 3.47)
Apr  4 11:59:17 pc3 healthd: A value of -10.22 for -12 Volt with a range of (-13.20 <= n <= -10.80)
Apr  4 12:02:17 pc3 healthd: A value of 37.00 for CPU #0 Temperature with a range of (10.00 <= n <= 30.00)
Apr  4 12:04:16 pc3 kernel: CS134 sample module initialized
Apr  4 12:04:49 pc3 kernel: CS134 sample module cleaned up
Apr  4 12:05:39 pc3 kernel: CS134 sample module initialized
Apr  4 12:06:08 pc3 kernel: CS134 sample module cleaned up
Apr  4 12:06:56 pc3 kernel: CS134 sample module initialized
Apr  4 12:07:17 pc3 kernel: CS134 sample module cleaned up
[geoff@NodeA modules-sample]$ ls
Makefile  modsample.log  trivmodule.c  trivmodule.o
[geoff@NodeA modules-sample]$ exit
exit

Script done on Thu Apr  4 12:11:46 2002
```