Emulab

CS134
Advanced Operating Systems

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

Getting Going

- Bring up `www.emulab.net`
- Click **Request Account**, then **Join an Existing 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

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

Getting a Machine

- Click **Begin Experiment**
- Default most things except project
- Name is (e.g.) `geoff-134-1`
- NS file is `/proj/HMC_CS134/onemachine.ns`
- Enable **Max. Duration**
- After submitting, click **realtime** to find out node name

Getting Access

- `ssh` to `users.emulab.net`
- Type "`console pc`*nnn*" where `nnn` is given in **realtime** output
- Log in as yourself
- Get out of `console` later with CTRL-] and `quit`.

Doing Experiments

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

Finishing Up

- Get out of `console` with CTRL-] & `quit`
  - ▷ Or just terminate ssh session
- Click **Experiment List** in Web interface
- Click on name of your experiment (EID)
- Click **Terminate experiment** and confirm

Sample Module Makefile

```
CFLAGS = -c -Wall -D__KERNEL__ -DMODULE \
        -I$$HOME/usr/src/linux/include

all:    trivmodule.o
```

Sample Module

```c
#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;
}
```


Sample Run (1)

```
Script started on Tue Nov 18 02:27:49 2003
[geoff@nodea ~/modules-sample]$ rm trivmodule.o
[geoff@nodea ~/modules-sample]$ make -f Makefile.modules
cc -c -Wall -D__KERNEL__ -DMODULE -I$HOME/usr/src/linux/include   -c -o trivmodule.o trivmodule.c
[geoff@nodea ~/modules-sample]$ sudo insmod trivmodule.o
Warning: loading trivmodule.o will taint the kernel: no license
  See http://www.tux.org/lkml/#export-tainted for information about tainted modules
Module trivmodule loaded, with warnings
[geoff@nodea ~/modules-sample]$ lsmod
Module                  Size  Used by    Tainted: P
trivmodule               892   0 (unused)
adm9240                 7328   0 (unused)
i2c-proc                7936   0 [adm9240]
i2c-piix4               4740   0 (unused)
i2c-core               18304   0 [adm9240 i2c-proc i2c-piix4]
nfs                    82016   6 (autoclean)
nfsd                   73920   8 (autoclean)
lockd                  54528   1 (autoclean) [nfs nfsd]
sunrpc                 72724   1 (autoclean) [nfs nfsd lockd]
eepro100               20016   5
[geoff@nodea ~/modules-sample]$ sudo rmmod trivmodule
```

Sample Run (2)

```
[geoff@nodea ~/modules-sample]$ sudo tail /var/log/messages
Nov 18 02:25:52 nodea  -- geoff[1391]: LOGIN ON ttyS0 BY geoff
Nov 18 02:28:17 nodea kernel: CS134 sample module initialized
Nov 18 02:28:22 nodea healthd: A value of 0.00 for CPU #0 Temperature with a range of (10.00 <= n <= 30.00)
Nov 18 02:28:22 nodea healthd: A value of 0.00 for CPU #1 Temperature with a range of (10.00 <= n <= 30.00)
Nov 18 02:28:22 nodea healthd: A value of 0.00 for Case Fan Cooling Fan with a range of (3000.00 <= n <= 9999.00)
Nov 18 02:28:22 nodea healthd: A value of 1.71 for CPU #0 Core Voltage with a range of (1.95 <= n <= 2.05)
Nov 18 02:28:22 nodea healthd: A value of 2.53 for CPU #1 Core Voltage with a range of (1.95 <= n <= 2.05)
Nov 18 02:28:22 nodea healthd: A value of 2.53 for -12 Volt with a range of (-13.20 <= n <= -10.80)
Nov 18 02:28:22 nodea healthd: A value of 0.00 for -5 Volt with a range of (-5.50 <= n <= -4.50)
Nov 18 02:28:39 nodea kernel: CS134 sample module cleaned up
[geoff@nodea ~/modules-sample]$ exit

Script done on Tue Nov 18 02:29:07 2003
```