

Introduction to 15-412

David A. Eckhardt
School of Computer Science
Carnegie Mellon University

de0u@andrew.cmu.edu

Outline

People

- me
- us
- you

Some administrative stuff

- **academic conduct**

Structure/approach

- group programming

Development models

Revision control

Reading material

- books, newsgroups

Operating Systems

Dave Eckhardt

412 role: instructor

At CMU since 1989

Building Unix kernels since ~1985

- PDP-11, V7
- not really a BSD bigot

Don't go here

- <http://www.cs.cmu.edu/~dave>

Steve Muckle

412 role: lab instructor

- owner of project runtime environment

CMU status

- M.S., ECE, 2003

Headlines, word of the day

- <http://www.smuckle.com/>

TA's

Rick Morrison

- rvm@andrew.cmu.edu

Zach Anderson

- zach@andrew.cmu.edu

Yuen-Lin Tan

- tyl@cmu.edu

You (all)

Demographics (current)

- Junior/Senior/other?
- CS/ECE/other?
- Group programming before?

Career plans

- Industry
- Graduate school
- mountain top?

Reading in CS

- read a Ph.D. thesis?
- read an academic journal article?
- attended an academic conference?
- read a non-class CS book last semester?

Some administrative stuff

Information sources

- <http://www.cs.cmu.edu/~412>
- academic.cs.15-412.announce
- academic.cs.15-412.qa

Private issues

- staff-412@cs.cmu.edu
- Yes
 - I have a final exam conflict
- No
 - Is it OK for me to use a linked list for ...

Academic conduct

“Academic honesty”

- Consult syllabus for details
- Learning is good
 - ...practices which avoid learning are not!
- Plagiarism is bad
 - ...credit must be given where due.

Being a partner

- Telling your partner you are interviewing is responsible
- Vanishing for a week is not

The deadline disaster

- The grade is not the (pedagogical) problem
- *Learning* and *retention* are threatened by sleep deprivation

Structure/approach

Text - Operating System Concepts

- Theoretical background
- Classical algorithms/approaches
- Real-world examples

Projects

- Implementation of a multi-tasking OS
- Running on an x86 hardware simulator
 - (or a handy x86 PC)
- Interrupt handlers
- Kernel
- User-level concurrency
- File system

Group programming

Why?

- *Not* for instructor's convenience!
- Allows attacking larger problems
- Most careers involve group efforts

Styles

- Waterfall
- Spiral
- “Extreme Programming”
- “Pair Programming”
 - Williams & Kessler, “Pair Programming Illuminated”

Revision control

Other buzzwords

- source control
- configuration management

Goals

- Re-create past builds
- Compare stable states
- Control inter-developer interference
- Manage multiple shipped product versions

Even for “small” projects?

- “It worked three hours ago, but now it dies on startup...”
- I thought I fixed that already...

Reading material

comp.risks

- developers should read this
- managers should read this
- ...

“Book report” assignment

- Books
 - Schneier, Secrets & Lies
 - McKusick et al., Design & Implementation of 4.4 BSD
- Ph.D. Dissertations
 - Massalin, Mike Young, Al Spector, Satya
- Research project bundles
 - EROS, Plan 9, Amoeba, Locus, Bayou, Autonet
- Suggestions: de0u+412books@andrew.cmu.edu

“The buck stops here”

Nobody else to blame

- No user action can crash the machine
- You can't just crash when the file system fills up

Central point of horror

- “Exceptions” are *not* exceptional
 - Zero divide, page fault, access violation - all the time
- Hardware devices wedge (maybe not daily)
- Users will try to use 130% of *everything*

“No Way Out”

Customer or inmate?

- No (ordinary) user can steal another user's file
- No (ordinary) user can wipe out the entire file system
 - Google “FreeBSD-SA-02:35”

Controlled sharing

- Memory quotas
- Disk quotas
- Task priorities
- Packet scheduling

“The tight place”

Abstractions are *limited*

```
int fact (int n) {
    char errmsg[1024];

    if (n < 0) {
        snprintf(errmsg, sizeof(errmsg), "invalid: %d",n);
        klog(errmsg);
        return (-1);
    } else if ((n == 0) || (n == 1)) {
        return (1);
    } else {
        return (n * fact(n - 1));
    }
}
```

“Failure is not an option”

“The disk block is bad”

- retry
- map in another block

“The whole disk is broken”

- RAID

“A cosmic ray nuked that DRAM cell”

- ECC

“Somebody ejected the Ethernet card”

- better traverse that ring buffer carefully!

No rest for the weary

Completion is not a goal

- An OS should run “forever”
 - maybe: the lifetime of the hardware!

Mistakes add up over time

- Correctly handle 99.9% of clock interrupts...
 - ...lose 1.5 minutes per day!
- Leak 1 memory page per process exit
 - ...forget it!

“OS is an attitude”

Narrow definition

- OS = layer between hardware and application

The “OS state of mind”

- Web server
 - <http://www.kegel.com/c10k.html>
- IMAP server
- IP router
- Smartcard
- Database

Closing

Read

- Chapters 1 & 2

Suggest

- a book or collection of papers
- de0u+412books@andrew.cmu.edu

Select

- ...a partner!
- Not this week
- Sooner than you think