

# The OS Frame of Mind

Dave Eckhardt

[de0u@andrew.cmu.edu](mailto:de0u@andrew.cmu.edu)

Babu Pillai

[pspillai@andrew.cmu.edu](mailto:pspillai@andrew.cmu.edu)

# Outline

- The buck stops here
- No way out
- The tight place
- Failure is not an option
- No rest for the weary
- The OS frame of mind

# “The buck stops here”

- Nobody else to blame
  - No user action should crash the machine
  - Can't just flee when the file system fills up
- Central point of horror
  - “Exceptions” are **not** exceptional
    - Zero divide, page fault, access violation – **every second**
  - 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's file
  - No (ordinary) user can wipe out the entire file system
    - See “FreeBSD-SA-02:35”
- Controlled sharing
  - Memory quotas
  - Disk quotas
  - Task priorities
  - Packet scheduling

# The tight place

- Abstractions are *limited*
  - What's wrong with this code?

# Just a wafer-thin factorial?

```
int fact (int n) {
    char errmsg[1024];
    if (n < 0) {
        sprintf(errmsg, sizeof (errmsg),
            "invalid: fact(%d)\n", n);
        klog(errmsg);
        return (-1);
    } else if (n <= 1) {
        return(1);
    } else {
        return (n * fact(n - 1));
    }
}
```

# Failure is not an option

- The disk block is bad
  - Retry, or map in another block
- The whole disk is broken
  - RAID
- A cosmic ray nuked that DRAM cell
  - ECC
- Ethernet card *ejected*
  - Better traverse that ring buffer carefully!

# No rest for the weary

- Completion is not a goal
  - OS should run “forever”
    - Maybe for *entire lifetime of 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!

# The OS frame of mind

- 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