The OS frame of mind

Dave Eckhardt
de0u@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
    - Google “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) {
    snprintf(errmsg, sizeof
(errmsg),``invalid: %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