

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: 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