OS Week 1 Notes

- Overview

  `pstree | more` the first with an id of 1 will say either `init` or `systemd` this process starts all other processes.

  Hands on labs and hws, but we won't be re-inventing the wheel.

- Different OS

  1. Windows
  2. Mac
  3. Linux
  4. and 100's of more

- How computers work

  1. Stove = CPU
  2. Cupboards = Hard Drive / SSD
  3. Counter = Memory
  4. Chef = Chipset

- Turning on the computer

  1. Power turns on
  2. BIOS executes
     a. hardware check
     b. hardware initialization
     c. basic configuration
  3. Master boot record
  4. Boot loader
  5. Kernel
  6. OS

The kernel is in control of everything CPU, Memory, and Devices. Then the applications are built on the kernel.

- Architectures
  - Monolithic
    - One address space
    - CPU runs in most privileged mode
    - Fast
  - Microkernels
    - Run in user mode
    - Does not require a system restart
    - Modular

  Linux is Monolithic and modular

- Roles of the OS
  - Extend the machine
    - HAL
    - fopen(...), fread(...)
    - x=7
    - <Save>
  - Resource manager
    - System’s runtime
    - multi-processing
    - muti-user

  The both of these create a kernel level API

- How to choose an OS
  1. By job

    a. Video Editing, Mac
    b. Security, RedHat Linux
    c. Haacking, Kali Linux
    d. Dev and Systems, Ubuntu
    e. etc
2. Preference
    a. Ubuntu - fast releases
    b. Mint - only mature packages
    c. CentOS - stable and small

Windows integrates GUI

Linux is headless (no GUI)

Mac and Windows are proprietary (run by a company)

▼ HAL in layers

1. HW
2. OS/Kernel/HAL/System calls
3. Libraries
4. User Libraries

Scope increases as the list goes down. HW is faster but User Libraries are friendlier to users

▼ OS Sub-Systems

▼ File System (FS)

- Methods and data structures to represent, store and retrieve information
- Many FS types
- Memory and Hard Drives

        - Volatile vs. persistent
    - Linux
        - ASCII or Binary
        - File extensions are meaningless
        - Magic number (first bytes of the file
        - Devices are files
        - One root, devices attached anywhere in FS
        - Many FS formats in one FS
    - Windows
        - Extension decides file format and execution
        - Many different file types
        - FS root ties to the HD
        - One FS type per HD
    - FS by Organization
        - Linked-list structure
            - Scalable
            - slower
            - not as fault tolerant
        - Array like structure
            - fixed size
            - limited storage device size
            - fast
            - resilient

▼ Process management (PS)

- Memory and CPU
- Wide range of roles

- Process creation
  - PCD & RCB structs
  - Frame stack address space
  - frame stack address space
  - Resources
  - scheduler entry
- Process loading
  - use of common libraries
  - relocation to different physical space
- OS ↔ Process communication
  - Termination
  - SIG_STOP
  - SIG_CONT
  - return()
  - exit()

▼ Memory management Unit (MMU)

L1 Memory - Registers

L2 Memory - Small Cache

L3 Memory - RAM

L1 and L2 are in the CPU cores

L3 is stored in Memory

Input / Output

Protections

Shell