EECS 2032 Introduction to Embedded Systems

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EECS 2032E

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- Office hours TTH 12:00-3:00 or by appointment

Grading Details

- Quizzes and attendance 10%
- Lab 25%
- 3 tests 20%, 25%, 20%(total 65%)

LAB Policy

- Labs are submitted electronically.
- The due date is Wednesday midnight of every week (there is no submission for lab 1, you have to demo the lab to the TA during the lab time.
- labs are marked electronically, 75% of the marks are calculated by comparing your code output to the model output. That means you have to be very careful. Follow the specifications carefully, an extra comma, new line, or a space might make the difference

About the course

- By the end of the course, the students will be expected to be able to:
  - Explain the architecture of a simple microcontroller.
  - Use the microcontroller peripherals to communicate with the outside world.
  - Design, develop and test embedded applications in C.
  - Design and implement shell scripts.

Text

- Top hat “Introduction to Embedded Systems”

Introduction

- Course Content
  - UNIX (LINUX)
    - Using and understanding the Linux operating system
    - Writing and testing shell scripts
  - C
    - Learn how to write test, and debug C programs.
  - Write embedded applications to run on a microcontroller board

WHY C and UNIX

- Wide use, powerful, and fast
- Both started at AT&T Bell Labs
- UNIX was written in assembly, later changed to C
- Many variants of UNIX

WHY C and UNIX

- The first part of the course is Linux and bash
- The second part is C
- The third part is embedded programming
- We will start with a quick introduction to Unix to be able to start the labs.
- Lab 1 is this week (introduction to Unix)
- Lab policy

Introduction to Unix

- Please check the tutorial at http://www.cs.sfu.ca/~ggbaker/reference/unix/
- The first 4 tutorials
- Blackboard

UNIX

- What does an OS do?
  - File management
  - Scheduling
  - Memory management
  - I/O management
- Examples

UNIX

- OS includes
- Kernel: Performs key OS functions
- System programs: various tools
- Shell: Interface to the user

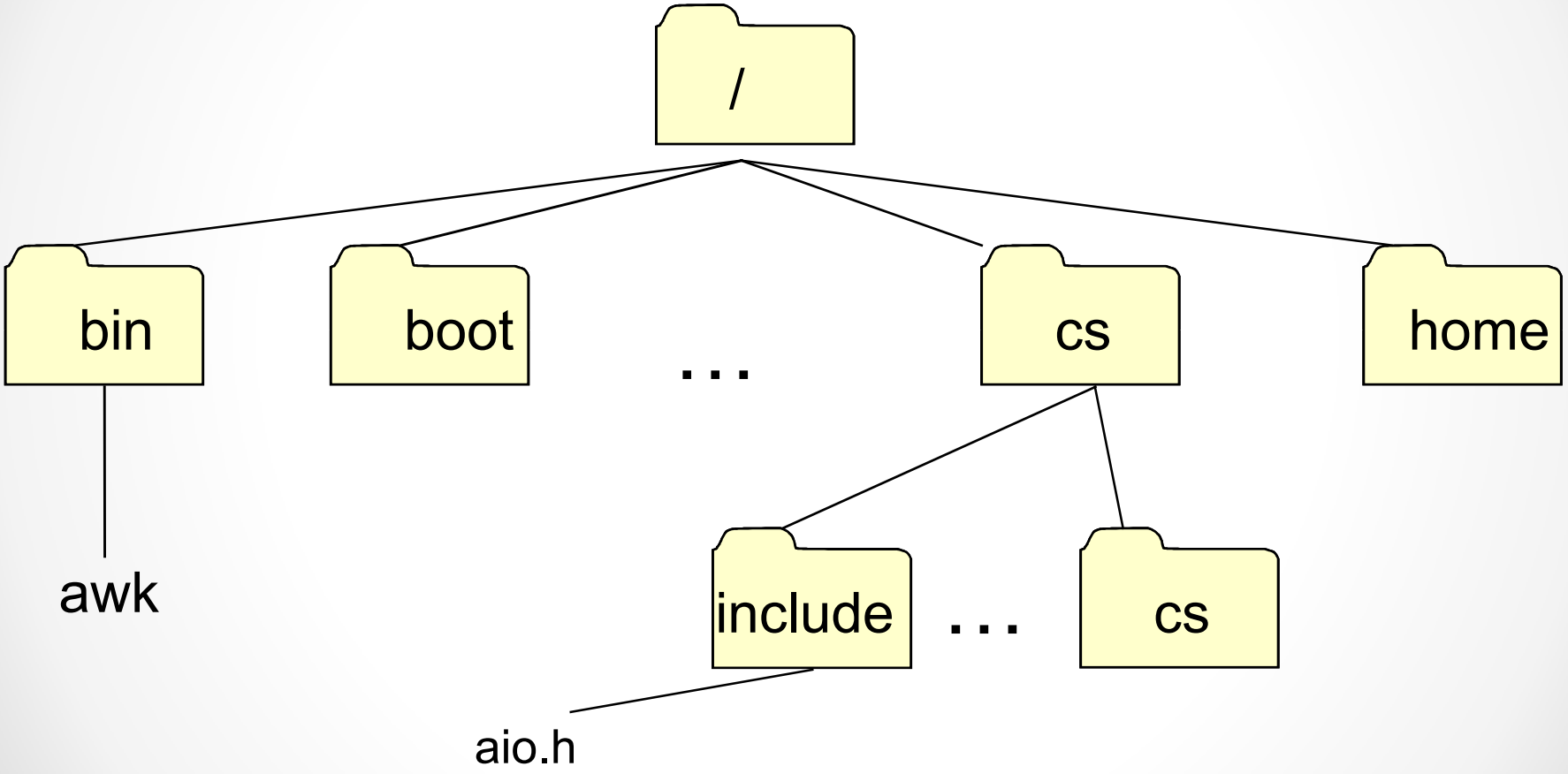
Processes

- Each program running is called a process
- Each process has its own identification PID
- If the program is running twice, even by the same user, these are 2 different processes.

File System

- In Unix, the files are organized into a tree structure with a root named by the character '/'.
- Everything in the file system is a file or subdirectory

File System



File System

- File names could be relative (with respect to the current directory) or using full path name (relative to /) for example aio.h or /cs/include/aio.h
- Your home directory is ~username, so in my case ~aboelaze/test.c is equivalent to /cs/home/aboelaze/test.c

Devices

- /dev contains devices, just like any other file (fopen, fread, fwrite, ..) but it communicate with a device.
- /dev/tty
- /dev/null
- /dev/zero

Unix Commands

- ls cp mv rm mkdir cd pwd cat less more head tail ….
- bg, fg, CTRL-C, CTRL-Z
- kill ps od diff ln echo …
- Redirection and pipes Examples

Basic Unix Commands

- ls, cp, mv, rm, mkdir, cd, pwd
- cat, more, less, head, tail
- diff, who, date, ps, kill, od, du, cal
- chmod, chgrp, pipeline
- Redirection
  - command >file
  - command >>file
  - command <file >file1

Unix Commands

- tigger 215 % ls –las
- total 44
- 4 drwx------ 2 aboelaze faculty 4096 Nov 29 13:44 ./
- 4 drwx------ 9 aboelaze faculty 4096 Nov 29 14:47 ../
- 4 -rw------- 1 aboelaze faculty 184 Nov 18 13:30 data
- 4 -rw------- 1 aboelaze faculty   23 Nov 28 19:52 file1
- 4 -rw------- 1 aboelaze faculty   24 Nov 28 19:52 file2
- 4 -rw------- 1 aboelaze faculty 481 Nov 29 12:27 mergefiles.awk
- 4 -rw------- 1 aboelaze faculty 178 Nov 28 19:32 p1
- 4 -rw------- 1 aboelaze faculty 1245 Nov 18 13:29 prchecks.awk
- 4 -rw------- 1 aboelaze faculty   83 Nov 14 17:46 t
- 4 -rwx------ 1 aboelaze faculty   35 Nov 21 13:08 test.sh*
- 4 -rw------- 1 aboelaze faculty   50 Nov 1 18:31 unmatched
- chmod 744 file What does it mean?
- chmod [ugo][+-][rwx] chmod ug+rw p1

Protection

- tigger 215 % ls –las
- total 44
- 4 drwx------ 2 aboelaze faculty 4096 Nov 29 13:44 ./
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- 4 -rw------- 1 aboelaze faculty 184 Nov 18 13:30 data
- r-x--x-w-
- How to change file permission its
- Chmod
- SGID chmod g+s or 2700 r w x - - s - - x
- SUID chmod u+s or 4750 r w e - - - - - -
- $PATH man
- alias command (source)

PATH

- The shell searches in PATH looking for the command you typed
- echo $PATH .:/usr/local/bin:/usr/ucb: /usr/bin /usr/etc:/etc:/bin:/usr/bin/X11
- set path = ($path /a/b/c) --csh
- PATH=$PATH:/a/b/c --sh
- Aliases and startup files