Managing Linux Systems with Embedded Perspective

TX00EX85-3002

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Contents & Grading

Course Contents

- Introduction to Embedded Linux
- Compilation
- Make
- CMake
- Embedded Linux Build tools
- Cross compilation and Embedded Development

Grades

- No exam
- Weekly Exercises
  - 6 Exercises
  - Max 10 points per exercise
- Grades
  - 30 pts = 1
  - 36 pts = 2
  - 42 pts = 3
  - 48 pts = 4
  - 56 pts = 5

Intro to Embedded Linux

Linux

A History

- 1983
  - Dev of GCC, GlibC, GDB, and other tools
- 1991
  - Linux kernel Project created Completely free OS GNU/Linux
- Linux gains popularity on server systems in the mid 90s
- Early 2000s Linux gains popularity on embedded systems
- Late 2000s Linux is common on mobile phones
- 2012 Linux is available on cheap hardware SBCs

Free Software

- A program is free when all users have the following available
  - Ability to use the software for any purpose
  - Ability to study and modify it
  - Ability to redistribute
  - Ability to make modified versions available
- Can be used for commercial as well as consumer purposes
- Sources should be available and modifiable by customers

What is Embedded Linux?

Advantages of Linux for Embedded

Reusability

- Available on a wide variety devices
- Extensive support for protocols

Control

- Not stuck with a single vendor and their libraries/features

Low Cost

- No royalties
- Free devtools

Community Support

Where do we see embedded Linux today?

SPACEX

Hardware Support

- If you have heard of an architecture and it is 32 or 64 bits, then it can likely be used with Linux
  - 8/16 bit hardware not supported
- Most components are architecture independent
  - Toolchains, bootloaders, and kernel are dependent on architecture

Linux memory and storage

- Can function with as little as 8MB of RAM and 4 MB of storage
- Supports Block and Raw Flash storage
  - USB, SD, SATA
  - NAND and NOR with file system support

Comms

- Linux supports most common communication protocols/busses
  - I2C, SPI, 1-wire, PCI, USB, CAN
- Robust Network Support
  - Ethernet, WiFi, IP, TCP, UDP, Advanced Routing

Embedded Linux Development

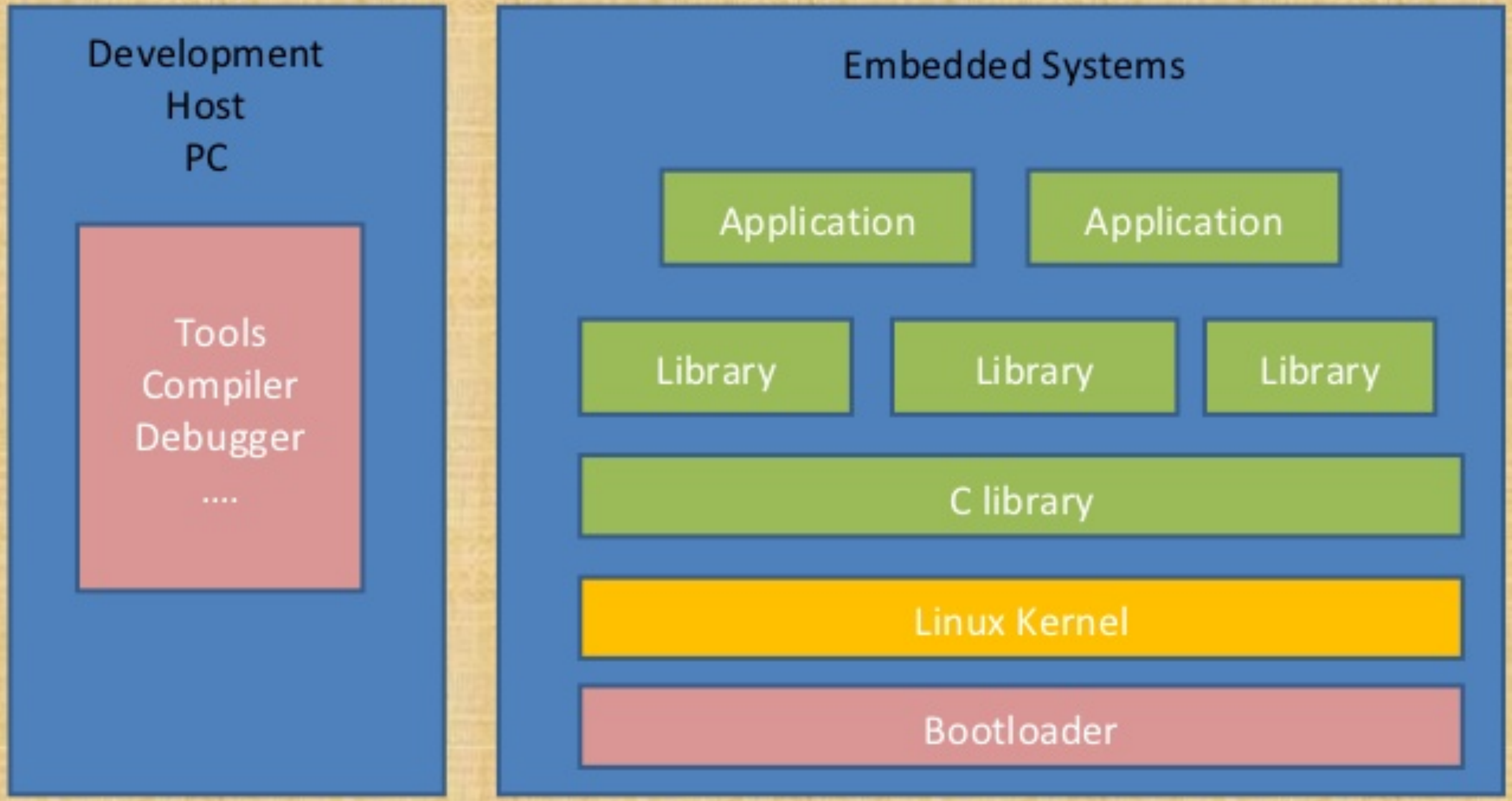


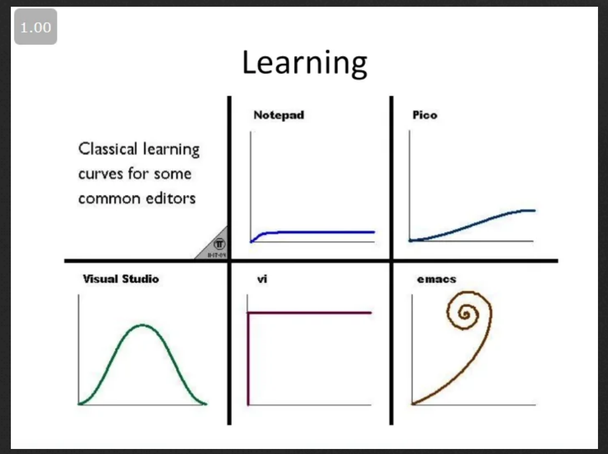
Image: https://ucgeeks.wordpress.com/2015/04/20/embedded-linux-for-beginner/

Required software components

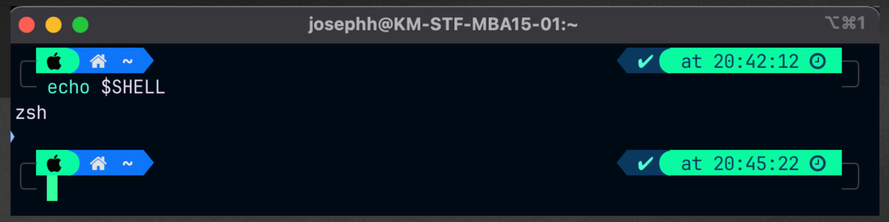
- Kernel
- Bootloader
  - Initializes, loads, and executes the kernel from RAM
- C library
  - Interface between user space and kernel
- Libs and applications
- Cross compilation tool chain

Text Editors and Terminal

- Convenient and unavoidable in Linux Systems
- For a lot of tasks typing is a lot quicker than clicking through multiple layers of a GUI
- Shell scripting is very useful/powerful
- There are many text editors that have shocking abilities
  - Vim, Neovim, Emacs, Geddit, Nano... and more



Environment Variables and Path

- Environment variables are dynamic symbolic names for things used by the shell and its child processes
  - for example your default shell is defined by the SHELL variable
  - 

  - One very important environment variable is the PATH variable
    - PATH tells your Linux system where to search for executables
    - If you want something to be executable system wide you must make sure that it is exported to the PATH variable