From Power-On to Login Prompt

▶ What happens when power is applied?

▶ Most computers go through a sequence like this:
   1. the CPU's Program Counter (PC) is set to a fixed value (0xFFFF FFFC for the PowerPC)
   2. the CPU fetches an instruction at that address; this means the memory has to have a valid instruction
      ▶ non-volatile memory
      ▶ "something" has to store the instruction
   3. boot software takes over

Boot Software

- ▶ Depending on type of system...
  - ▶ stand-alone C program
  - ▶ monitor (that may/may not invoke stand-alone C program)
  - ▶ Power-On Self Test (POST)/BIOS
  - ▶ Bootloader

Monitor

- $\boxed{\textbf{\textit{monitor}}}$ — a program (usually in non-volitile memory) that
    - puts an embedded systems board into a known state
    - often included a primitive debugger
    - could be used to download user-programs into RAM (Intel HEX files or Motoroloa S-Records could be copied over a serial communication line)

- monitor often came with a collection of subroutines that a stand-alone C program can use

Board Support Package (BSP)

▶ along with a developer board, companies selling microprocessors or microcontrollers would make available a board support package

▶ **Board Support Package** (BSP) — might include (a) monitor, (b) pre-written subroutines, (c) a cross-compiler, and (d) sample applications

POST/BIOS

the standard PC package had a similar set up but no monitor board-support package

▶ **POST** — tested standard peripherals, put main board into a known state

▶ BIOS (Basic Input/Output System) was the name for a set of subroutines implemented in ROM that the operating system used

▶ evolved over time to have rich functionality that you see in a modern PC

Bootloader

- ► often used to start start an operating system, bootloaders

- ► ...

- ►

Bootloader Examples

- ▶ LILO (Linux Loader)

- ▶ grub *leftarrow* de facto PC bootloader today

- ▶ U-boot (Universal Bootloader) is popular with embedded systems

- ▶ simpleboot — comes with PowerPC architecture in Linux, this is a simple program that loads the kernel and starts it