LinuxBIOS
freedom for your motherboard

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What is BIOS?

- BIOS stands for: Basic Input/Output System;
- Firmware - stored inside a chip (ROM, EPROM, Flash);
- Initializes the hardware
How commercial BIOS works?

1. Power-on / reset start at 0xFFFFFFFFF0
2. Initialize RAM, PCI, VIDEO, IDE, etc (still on real mode - 16bits)
3. Execute POST
4. Configure Interrupt Services
5. Execute SETUP
6. F1 / DEL?
   - yes: Configure Interrupt Services
   - no: MBR
7. reset
Commercial BIOS' problems

- Slow – commonly runs on real mode;
- Redundant – Modern Operating Systems initialize hardware by itself; They also don't use BIOS Interrupt services;
- Complexity – commercial BIOS normally are written in assembly;
- Suboptimal – some commercial BIOS configure devices in a suboptimal way;
- BUGs – you can't fix it yourself!
What is LinuxBIOS?

- A FOSS project to replace closed BIOS firmware;
- Started by Ron Minnich at Los Alamos National Laboratory 1999;
- It was developed to solve cluster's BIOS configuration problem;
- It supports x86, Alpha and PowerPC;
- The first mainboard supported was Intel L440GX+.
Why use LinuxBIOS?

- It starts your system faster;
- It is free;
- It is reliable;
- It is customizable;
- Any BUG will be fixed fast;
- No DRM by default;
- It is FUN;
How LinuxBIOS works?

- Power-on / reset start at 0xFFFFFFFF0
  - Switch to Protect mode – 32 bits
    - Initialize chipsets north/southbridge superI/O
      - Configure serial for debug info
      - Initialize DRAM
    - Execute payload Linux, FILO, Etherboot
How is it done without RAM?

- There are two approaches:
  - ROMCC
  - Cache As Ram (CAR)
ROMCC

- C compiler which compile to “stackless assembly” way;
- It uses some especial processor registers to store variables (mmx, sse);
- It is deprecated, use CAR;
CAR - Cache As Ram

- It use processor cache (L1) as RAM;
- Cache is SRAM memory;
- The cache need be in **NO-FILL** mode;
- All mainboard will use it on LinuxBIOSv3;
How to initialize DRAM?

- CPU
- Northbridge
- Southbridge
- SuperIO

- DRAM
- SEEPROM

SMBUS
Interesting LinuxBIOS Features

- serial console at early;
- serial console over USB 2.0;
- fallback system;
- vm86 emulator;
- small footprint (~64KB);
Getting started

- You can use QEMU:
  
  - Download LinuxBIOS, linux kernel, busybox, mkelfImage,
  - Make the rootfs (compile busybox);
  - Compile a minimal linux kernel;
  - Convert the kernel image and rootfs to ELF;
  - Compile LB for QEMU using this ELF as payload;
  - Start QEMU using this LB image
Installing LinuxBIOS in Mainboard

- Download LinuxBIOS;
- Get FILO or linux kernel + busybox;
- Compile FILO or linux kernel and busybox;
- If linux kernel and busybox, convert to ELF using the mkelfImage;
- Compile LinuxBIOS with the ELF payload;
- Reprogram the BIOS Flash.
How to program the FLASH?

- There are some approaches:
  - using an external programmer;
  - using the flashrom program;
  - using a NIC as programmer (EXPERIMENTAL)
    (http://ctflashe.sourceforge.net)
How to add support to your motherboard?

- Enumerate the resources (lspci is your friend);
- You will need the chip datasheet;
- Use this article as reference:
  http://www.linuxbios.org/Documentation
What motherboard to buy?

- The following desktop motherboards are supported by LinuxBIOS:
  - Gigabyte GA-M57SLI-S4;
  - MSI K9N Neo-F;
  - MSI Platinum;
LinuxBIOS x DRM

- Do you know Dr. Fritz (fritz-chip)?
- Xbox360 is best DRM hardware example;
- In few years we will see more examples;
- Users needs say “NO” to DRM sw/hw:
  - Don't buy computer w/ EFI BIOS (i.e. MacIntel);
  - Don't buy DRM hardware;
  - Use free and open source sofware;
  - Use LinuxBIOS in your computer;
  - Ask hardware vendor to support LinuxBIOS;
LinuxBIOS future

• There are some news and willing:
  – Easy compilation (n curses based);
  – Support for more desktop motherboards;
  – Motherboard manufactured with LinuxBIOS;
  – Quality Assurance – LinuxBIOS automatic test for all supported mainboards;
Thanks

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Thanks
Questions?
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Gigabyte M57SLI-S4
MSI Platinum