

CSGE602055 Operating Systems

CSF2600505 Sistem Operasi

Minggu 03: BIOS, Loader, Systemd, & I/O

Rahmat M. Samik-Ibrahim

Universitas Indonesia

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Minggu 00	29 Aug - 05 Sep 2017	Intro & Review
Minggu 01	07 Sep - 12 Sep 2017	IPR, SED, AWK, REGEX, & Scripting
Minggu 02	14 Sep - 19 Sep 2017	Protection, Security, Privacy, & C-language
Minggu 03	26 Sep - 30 Sep 2017	BIOS, Loader, Systemd, & I/O
Minggu 04	03 Okt - 07 Okt 2017	Addressing, Shared Lib, Pointer & I/O Programming
Minggu 05	10 Okt - 14 Okt 2017	Virtual Memory
Ming. UTS	15 Okt - 24 Okt 2017	
Minggu 06	26 Okt - 31 Okt 2017	Concurrency: Processes & Threads
Minggu 07	02 Nov - 07 Nov 2017	Synchronization
Minggu 08	09 Nov - 14 Nov 2017	Scheduling & Network Sockets Programming
Minggu 09	16 Nov - 21 Nov 2017	File System & Persistent Storage
Minggu 10	23 Nov - 28 Nov 2017	Special Topic: Blockchain
Cadangan	30 Nov - 09 Des 2017	
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Week 03: BIOS, Boot, Systemd, and I/O

- Reference: (Any Related Tutorial) (ETC 300-324) (SUP WEEK03) (OLD 10)
- Firmware
 - BIOS: Basic Input Output System.
 - UEFI: Unified Extensible Firmware Interface.
 - ACPI: Advanced Configuration and Power Interface.
- Operating System (Boot) Loader
 - BOOTMGT: Windows Bootmanager / Bootloader.
 - LILO: Linux Loader.
 - GRUB: GRand Unified Bootloader.
- Operating System Initialization
 - Init (legacy)
 - UpStart
 - Systemd
- I/O
 - Interrupt.
 - DMA.
 - ETC.

- Check Settings.
- Initialize CPU & RAM.
- POST: Power-On Self-Test.
- Initialize ports, LANS, etc.
- Load a Boot Loader.
- Handover to the Boot Loader.
- Provides "Native" (obsolete) Drivers only (not loadable).
- Provides "INT" services .
- Limitation.
 - Technology of 1970s.
 - 16 bits software.
 - 20 bits address space (1 MB).
 - 31 bits disk space (2 TB).

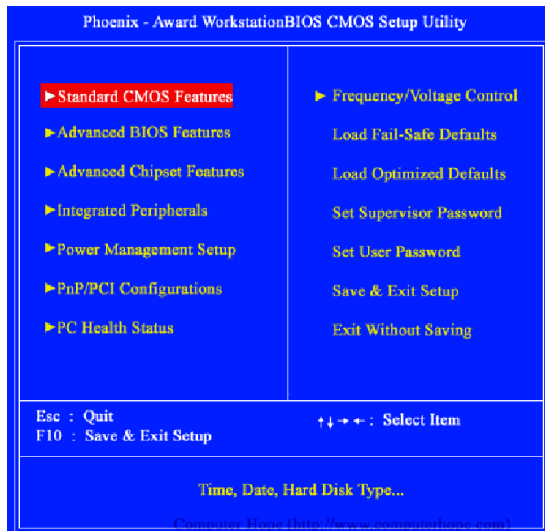


Figure: BIOS

- A Firmware Specification, not an Implementation!
- No (INT) service after boot.
- HII: Human Interface Infrastructure.
- Protected Mode.
- Flexible.
 - Technology of 2000s.
 - written in C.
 - (third party) loadable drivers and tools.
 - Emulate Legacy BIOS transition (MBR block, INT service).
 - UEFI Shell: environment shell for diagnostic (no need for DOS).



Figure: UEFI

Platform Initialization (PI) Boot Phases



Figure: UEFI Boot Process¹.

Operating System (Boot) Loader

- General
 - How/Where to start the operating system?
 - What to do?
 - How many ways to boot?
 - How many types of OS?
- GRUB/GRUB2: GRand Unified Boot system
 - Stage 1 (boot.img): MBR (Master Boot Record) – Where is everything
 - Stage 1.5 (core.img): generated from diskboot.img
 - Stage 2: Kernel Selection: Windows, Linux, BSD, etc.
- GRUB2
 - More flexible than GRUB legacy
 - More automated than GRUB legacy
- Disk Partition
 - MBR: Master Boot Record (1983).
 - GPT: GUID Partition Table (2010s).

GNU GRUB 2

Locations of *boot.img*, *core.img* and the */boot/grub* directory

Example 1: an MBR-partitioned harddisc with sector size of 512 or 4096Bytes



Example 2: a GPT-partitioned harddisc with sector size of 512 or 4096Bytes



Figure: GRUB¹.

¹Source Shmuel Csaba Otto Traian 2013

init (SYSV legacy)

- File: `/etc/inittab`.
- Folders: `/etc/rcX.d` — `X` = runlevel.
 - Seven (7) different runlevels:
 - 0 (shutdown).
 - 1 (single-user/admin).
 - 2 (multi-user non net).
 - 3 (standard).
 - 4 (N/A).
 - 5 (3+GUI).
 - 6 (reboot).
 - `SXX-YYY`: Start
 - `KXX-YYY`: Kill.
- One script at a time in order.
- dependency is set manually.

- Developer: Ubuntu.
- Folder: `/etc/init/`.
- Control: `initctl`.
 - `initctl list` – listing all processes managed by upstart.
- better support for hotplug devices.
- cleaner service management.
- faster service management.
- asynchronous.

The All New "systemd"

- Replaces (SYSV) init and UpStart.
 - better concurrency handling: Faster!
 - better dependencies handling: No more "S(tarts)" and "K(ills)".
 - better crash handling: automatic restart option.
 - better security: group protection from anyone including superusers.
 - simpler config files: reliable and clean scripts.
 - hotplug: dynamic start/stop.
 - supports legacy systems (init).
 - overhead reducing.
 - unified management way for all distros.
 - bloated: doing more with more resources.
 - linux specific: NOT portable.

- Control: systemctl.
- systemctl
- systemctl list-units
- systemctl start XXXX
- systemctl status ssh.service
 - status, start, restart, stop, disable.

PCH: Platform Controller Hub



Figure: PCH: Platform Controller Hub

Some Terms

- PCH: Platform Controller Hub
- PCIe: Peripheral Component Interconnect Express — 32 bits for (16 * 1x or 8 * 2x or 4 * 4x or 2 * 8x or 1 * 16x) * (2 direction) lanes.
- DMI: Direct Media Interface. Eg. DMI 2.0 (2 GB/s; ÅÜ4)
- GT/s: GigaTransfers per second
- 1 KB (KiloByte) = 1000 bytes — 1 KiB (Kibibyte) = 1024 bytes¹
- DDR4 SDRAM: Double Data Rate Fourth-generation Synchronous Dynamic Random-Access Memory. Eg. DDR4-2133: Memory Clock 266 MHz, 2133 MT/s, 17000 MB/s.
- SMB: System Management Bus
- SPI: Serial Peripheral Interface, a de facto standard bus.
- SATA: Serial AT Attachment. Eg. SATA 3.2 \approx 2 GB/s.

¹In IT tradition; 1 KB = 1024 bytes

- Direct I/O vs. Memory Mapped I/O
- Interrupts: Non Maskable (NMI) vs Maskable (MI)
- DMA: Direct Memory Access
- I/O Interface Dimensions: Character-stream vs. Block; Sequential vs. Random-access; Synchronous vs. Asynchronous; Sharable vs. Dedicated; Speed; Read Write – Read Only – Write Only.
- I/O Structure: Device (HW) — Controller (HW) — Driver (SW) — I/O (subsystem) — Kernel.
- I/O Blocking vs. Non-Blocking; Synchronous vs. Asynchronous.
- I/O Streams: APP – HEAD — MODULES — DRIVER – H/W.
- Where should a new algorithm be implemented? APP? — Kenel? — Driver? — Controller? — HW?

The End

- This is the end of the presentation.