CSGE602055 Operating Systems CSF2600505 Sistem Operasi Week 09: Storage, BIOS, Loader, & Systemd

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https://os.vlsm.org/
Always check for the latest revision!

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Operating Systems 2018-2 (Room 3114) R/M (Tu/Th 13-15) \mid I (Tu/Th 15-17)

Week	Schedule	Topic	OSC10
Week 00	04 Sep - 12 Sep 2018	Overview 1, Virtualization & Scripting	Ch. 1, 2, 18.
Week 01	13 Sep - 19 Sep 2018	Overview 2, Virtualization & Scripting	Ch. 1, 2, 18.
Week 02	20 Sep - 26 Sep 2018	Security, Protection, Privacy,	Ch. 16, 17
		& C-language	
Week 03	27 Sep - 03 Oct 2018	File System & FUSE	Ch. 13, 14, 15
Week 04	04 Oct - 10 Oct 2018	Addressing, Shared Lib, & Pointer	Ch. 9
Week 05	11 Oct - 17 Oct 2018	Virtual Memory	Ch. 10
Reserved	18 Oct - 19 Oct 2018	1	
Mid-Term	24 Oct 2018	MidTerm (UTS): 09:00 - 11:30	
Week 06	30 Oct - 05 Nov 2018	Concurency: Processes & Threads	Ch. 3, 4
Week 07	06 Nov - 12 Nov 2018	Synchronization & Deadlock	Ch. 6, 7, 8
Week 08	13 Nov - 21 Nov 2018	Scheduling	Ch. 5
Week 09	22 Nov - 28 Nov 2018	Storage, BIOS, Loader, & Systemd	Ch. 11
Week 10	29 Nov - 05 Dec 2018	I/O & Programming	Ch. 12
Reserved	06 Dec - 14 Dec 2018	1	
Final	19 Dec 2018	Final (UAS): 09:00 - 11:00	This schedule is
Extra	12 Jan 2019	Extra assignment	subject to change.

The Weekly Check List

•	☐ Resources: https://os.vlsm.org/
	☐ (THIS) Slides — https://github.com/UI-FASILKOM-OS/
	SistemOperasi/tree/master/pdf/
	☐ Demos — https://github.com/UI-FASILKOM-OS/
	SistemOperasi/tree/master/demos/
	☐ Extra — BADAK.cs.ui.ac.id:///extra/
	□ Problems — rms46.vlsm.org/2/195.pdf, 196.pdf,, 205.pdf
	☐ Text Book : any recent/decent OS book. Eg. (OSC10) Silberschatz
	et. al.: Operating System Concepts , 10 th Edition, 2018.
	☐ Encode your QRC with size upto 7cm x 7cm (ca. 400x400 pixels):
	"OS182 CLASS ID SSO-ACCOUNT Your-Full-Name"
	\square For Week 00 , send your embedded QRC before the 2^{nd} lecture
	mailto:operatingsystems@vlsm.org
	With Subject: OS182 CLASS ID SSO-ACCOUNT Your-Full-Name
	☐ Write your Memo (with QRC) every week.
	☐ Login to badak.cs.ui.ac.id via kawung.cs.ui.ac.id for at least
	10 minutes every week. Copy the weekly demo files to your own home
	directory.
	Fg (Week00): cp -r /extra/Week00/W00-demos/ W00-demos/

Agenda

- Start
- Schedule
- Agenda
- 4 Week 09
- 5 Week 09: Storage, BIOS, Loader, & Systemd
- 6 Storage Management
- RAID
- 8 Legacy BIOS
- UEFI
- 10 Operating System (Boot) Loader
- GRUB Map
- init (SYSV legacy)
- UpStart Ubuntu
- The All New "systemd"
- systemctl
- 16 The End

Week 09 Storage, BIOS, Loader, & Systemd: Topics¹

- Storage
- Storage Arrays
- BIOS
- Loader
- Systemd

¹Source: ACM IEEE CS Curricula 2013

Week 09 Storage, BIOS, Loader, & Systemd: Learning Outcomes¹

- Storage [Usage]
- Storage Arrays [Usage]
- BIOS [Usage]
- Loader [Usage]
- Systemd [Usage]

¹Source: ACM IEEE CS Curricula 2013

Week 09: Storage, BIOS, Loader, & Systemd

- Reference: (OSC10-ch11)
- Mass-Storage Structure
 - Obsolete: Magnetic Tape, Disket
 - Until When?: Magnetic Disk, DVD
 - Until When?: Mechanical Disk Arm Scheduling
 - Solid-State Disks (SSD)
 - (What is a) Flash Disk
- Attached-Storage
 - ullet Host-Attached Storage: via I/O
 - Network-Attached Storage (NAS): via distributed FS
 - Storage Area Network (SAN): dedicated Network

Storage Management

- Formating
 - Low Level (Physical)
 - High Level (FS)
- Boot Block
- Disk Partition
 - "MBR"-scheme
 - upto 4 primary partition
 - upto 2 TB disk
 - "GPT"-scheme
 - "unlimited" partition
 - "unlimited" disk
 - redundancy
- Swap Space Management: On Partition or FS?

RAID: Redundant Array of In* Disks

- RAID 0, 1, 5, 6, 10, 100
- Note (http://www.commodore.ca/windows/raid5/raid5.htm):
 - RAID was created to enhance data performance, reliability and availability.
 - Striping, parity checking and mirroring are three primary functions of RAID systems.
 - RAID performs its functions transparent to the operating system.
 - Systems are typically defined by ranks consisting of five disks each connected to one or two Disk Array Controllers.
 - Different RAID levels provide varying degrees of speed and data protection.
- Problems with RAID
- Stable-Storage Implementation

BIOS, Boot, & Systemd

- 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

Legacy BIOS

- 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).

BIOS

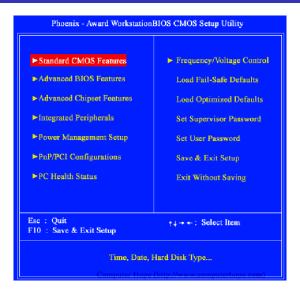


Figure: BIOS

UEFI

- A Firmware Specification, not an Implementation!
- No (INT) service after boot.
- HII: Human Interface Infrastructure.
- Protected Mode.
- Flexible.
 - Technology of 2000s.
 - writen 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).
- Problems
 - Who controls the Hardware?
 - Is "Secure Boot" a good thing?
 - How about a NASTY/LOCKING/TROJAN UEFI implementation?
 - Different DRIVERS.

UEFI



Figure: UEFI

UEFI Boot

Platform Initialization (PI) Boot Phases

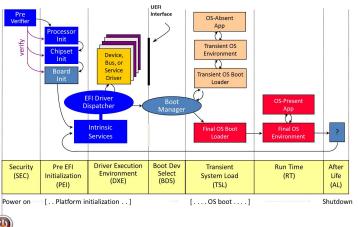


Figure: UEFI Boot Process¹.

Operating System (Boot) Loader

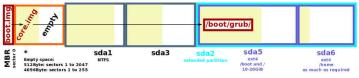
- General
 - How/Where to start the operating system?
 - What to do?
 - How many ways to boot?
 - How many types of OS?
- Disk Partition
 - MBR: Master Boot Record (1983).
 - GPT: GUID (Globally Unique Identifiers) Partition Table (2010s).
- GRUB: GRand Unified Boot system
 - Stage 1: a small boot.img inside the MBR.
 - Stage 1.5 (core.img): FS drivers after MBR.
 - Stage 2: Kernel Selection: Windows, Linux, BSD, etc.
- GRUB2
 - More flexible than GRUB legacy.
 - More automated than GRUB legacy.
 - Accept MBR and GPT.
 - Stage 1.5 (core.img): generated from diskboot.img.
 - No 1024 cylinder restriction.

GRUB Map

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.

UpStart - Ubuntu

- 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 concurency 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.

systemctl

```
for II in
   'systemctl list-unit-files | head -8; echo "(...)";
       systemctl list-unit-files| tail -8' \
   'systemd-analyze blame | wc -1; echo "===";
       systemd-analyze blame | head -15' \
   'systemctl --full | wc -1; echo "===";
       systemctl --full | head -10' \
   'systemctl list-units | wc -1; echo "===";
       systemctl list-units | head -10' \
   'systemctl list-units |grep .service|wc -l;echo "===";
       systemctl list-units|grep .service|head -10' \
   'systemctl list-units | grep ssh.service' \
   'systemctl status ssh.service' \
   'systemctl is-enabled ssh' \
   'journalctl' \
   'journalctl -b' \
dο
```

The End

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- This is the end of the presentation.