

CSGE602055 Operating Systems

CSF2600505 Sistem Operasi

Week 08: Scheduling

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<https://os.vlsm.org/>

Always check for the latest revision!

REV266 20-Feb-2021

Operating Systems 211³⁾ — PJJ from HOME

ZOOM: A [Mon (or Wed) 10] — B [Mon (or Wed) 15] — C [Tue (or Thu) 08]

Week	Schedule & Deadline ¹⁾	Topic	OSC10 ²⁾
Week 00	22 Feb - 28 Feb 2021	Overview 1, Virtualization & Scripting	Ch. 1, 2, 18.
Week 01	01 Mar - 07 Mar 2021	Overview 2, Virtualization & Scripting	Ch. 1, 2, 18.
Week 02	15 Mar - 21 Mar 2021	Security, Protection, Privacy, & C-language.	Ch. 16, 17.
Week 03	22 Mar - 28 Mar 2021	File System & FUSE	Ch. 13, 14, 15.
Week 04	29 Mar - 04 Apr 2021	Addressing, Shared Lib, & Pointer	Ch. 9.
Week 05	05 Apr - 11 Apr 2021	Virtual Memory	Ch. 10.
Week 06	26 Apr - 02 May 2021	Concurrency: Processes & Threads	Ch. 3, 4.
Week 07	03 May - 09 May 2021	Synchronization & Deadlock	Ch. 6, 7, 8.
Week 08	24 May - 30 May 2021	Scheduling + W06/W07	Ch. 5.
Week 09	24 May - 06 Jun 2021	Storage, Firmware, Bootloader, & Systemd	Ch. 11.
Week 10	07 Jun - 13 Jun 2021	I/O & Programming	Ch. 12.

¹⁾ The **DEADLINE** of Week 00 is 28 Feb 2021, whereas the **DEADLINE** of Week 01 is 07 Mar 2021, and so on...

²⁾ Silberschatz et. al.: **Operating System Concepts**, 10th Edition, 2018.

³⁾ This information will be on **EVERY** page two (2) of this course material.

STARTING POINT — <https://os.vlsm.org/>

- ❑ **Text Book** — Any recent/decent OS book. Eg. (**OSC10**) Silberschatz et. al.: **Operating System Concepts**, 10th Edition, 2018. See also <http://codex.cs.yale.edu/avi/os-book/OS10/>.
- ❑ **Resources**
 - ❑ **SCELE OS211** — <https://scele.cs.ui.ac.id/course/view.php?id=3134>.
The enrollment key is **XXX**.
 - ❑ **Download Slides and Demos from GitHub.com**
<https://github.com/UI-FASILKOM-OS/SistemOperasi/>:
os00.pdf (W00), os01.pdf (W01), os02.pdf (W02), os03.pdf (W03),
os04.pdf (W04), os05.pdf (W05), os06.pdf (W06), os07.pdf (W07),
os08.pdf (W08), os09.pdf (W09), os10.pdf (W10).
 - ❑ **Problems** — <https://rms46.vlsm.org/2/>:
195.pdf (W00), 196.pdf (W01), 197.pdf (W02), 198.pdf (W03),
199.pdf (W04), 200.pdf (W05), 201.pdf (W06), 202.pdf (W07),
203.pdf (W08), 204.pdf (W09), 205.pdf (W10).
 - ❑ **LFS** — <http://www.linuxfromscratch.org/lfs/view/stable/>
 - ❑ **OSP4DISS** — <https://osp4diss.vlsm.org/>
 - ❑ **DOIT** — <https://doit.vlsm.org/001.html>

Agenda

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Week 08 Scheduling: Topics¹

- Preemptive and non-preemptive scheduling
- Schedulers and policies
- Processes and threads
- Deadlines and real-time issues

¹Source: ACM IEEE CS Curricula 2013

Week 08 Scheduling: Learning Outcomes¹

- Compare and contrast the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating systems, such as priority, performance comparison, and fair-share schemes. [Usage]
- Describe relationships between scheduling algorithms and application domains. [Familiarity]
- Discuss the types of processor scheduling such as short-term, medium-term, long-term, and I/O. [Familiarity]
- Describe the difference between processes and threads. [Usage]
- Compare and contrast static and dynamic approaches to real-time scheduling. [Usage]
- Discuss the need for preemption and deadline scheduling. [Familiarity]
- Identify ways that the logic embodied in scheduling algorithms are applicable to other domains, such as disk I/O, network scheduling, project scheduling, and problems beyond computing. [Usage]

¹Source: ACM IEEE CS Curricula 2013

Week 08: Scheduling

- Reference: (OSC10-ch05 demo-w08)
- Scheduling
 - Basic Concepts
 - **WARNING:** It's just a BURST
 - IO Burst
 - CPU Burst
 - CPU Burst vs. Freq (See next slide)
 - Criteria: Utilization, throughput, {turnaround, waiting, response} time.
 - (Burst) Algorithm
 - FCFS, SJF, RR, Priority, Multilevel Queue.
 - Preemptive / Non-preemptive (Cooperative) Scheduling
 - I/O Bound / CPU Bound Processes
- Thread Scheduling
 - User-level → Process-Contention Scope (PCS): many to many/one.
 - Kernel-level → System-Contention Scope (SCS): one to one.
- Standard Linux Scheduling
 - Completely Fair Scheduler (CFS).
 - Real Time Scheduling.

CPU Burst: How Long (When)?



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MultiProcessor Scheduling

- Asymmetric Multiprocessing vs. Symmetric Multiprocessing (SMP).
- Processor Affinity: soft vs. hard.
- NUMA: Non-Uniform Memory Access.
- Load Balancing
- Multicore Processors
- Real Time Scheduling: Soft vs. Hard.
- Big O Notation
 - $O(1)$
 - $O(\log N)$
 - $O(N)$

The Two State Model

- CPU State – I/O State – CPU State – ...
 - n : processes in memory.
 - p : I/O time fraction.
 - p^n : probability n processes waiting for I/O.
 - $1 - p^n$: CPU utilization of n processes.
 - $\left[\frac{(1-p^n)}{n} \right]$: CPU utilization of ONE processes.
- Example: $p = 60\% \Rightarrow$ **CPU Utilization Per Process:** $\left[\frac{1-(60\%)^n}{n} \right]$

CPU Utilization	Multiprogramming (%)				
N	1	2	3	4	5
Per Process	40	32	26	21	18

- For 5 concurrent processes:
If total time is 100 seconds; for each process, the CPU time will be 18 seconds.

Linux From Scratch

- Week 08 (part 01).
 - Create a blank OVA file for a Debian Guest (uninstalled):
 - File/signature name: "LFSA.ova"/"LFSA.ova.asc" (armor, detach).
 - RAM: 1GB or better.
 - SATA Disk#1 (16 GB): Formated for root "/".
 - SATA Disk#2 (32 GB): Formated for LFS (unattached).
 - SATA Debian ISO Images link.
 - Install a Debian Guest:
 - File/signature name: "LFSB.ova"/"LFSB.ova.asc" (armor, detach).
 - root passwd: "osp"; hostname: "osp"; new account: "GitHubAccount".
 - install and update more packages.
 - Deliveries: Tarball "TXT/myW08.tar.bz2.txt" (signed, asymmetric-key, armor) of folder W08/ (**4 files**).
 - 1 Blank File: "YourAccount-YourStudentID.txt" (eg. "cbkadal-2006123456.txt").
 - 2 File: "LFSA.ova" (Blank OVA).
 - 3 File: "LFSA.ova.asc" (signature, armor, detach).
 - 4 File: "LFSB.ova.asc" (signature, armor, detach).
- Keep but **DO NOT SUBMIT** file LFSB.ova.

Week 08: Check List (Deadline: Monday, 30-Nov-2020).

□ Week 08: Linux From Scratch (part 1)(os08.pdf).

- ① Week 08 Token: **LINUXFROMSCRATCH**
- ② Read: (OSC10 chapter 05).
- ③ Update your Virtual Guest.
- ④ Visit <https://os.vlsm.org/GitHubPages/>. Review **Last Week TOP 10 List** and pick at least 3 out of your 10 closest neighbors. See <https://cbkadal.github.io/os211/TXT/myrank.txt>.
- ⑤ Create your **TOP 10 List** of Week 08 (e.g. <https://cbkadal.github.io/os211/W08/>).
Do not use lecture material. Please be more creative!
- ⑥ Run "chktoken LINUXFROMSCRATCH" and write the result into myW08token.txt.
- ⑦ Update your log (e.g. <https://cbkadal.github.io/os211/TXT/mylog.txt>).
- ⑧ Update bash script (e.g. <https://cbkadal.github.io/os211/TXT/myscript.sh>).
- ⑨ Make SHA256SUM and sign it (detached, armor) as SHA256SUM.asc.
- ⑩ Place the assignment result into W08/ folder and "tar" it into myW08.tar.bz2.
- ⑪ GnuPG encrypt (armor) to myW08.tar.bz2.txt.

The End

- ☐ This is the end of the presentation.
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