CSGE602055 Operating Systems CSF2600505 Sistem Operasi Week 08: Scheduling

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Operating Systems 2020-2 – (A, I, M) from HOME A/M [Tu 10-12, ZOOM] — I [Tu 08-10, ZOOM]

Week	Schedule	Topic	OSC10	
Week 00	15 Sep - 21 Sep 2020	Overview 1, Virtualization & Scripting	Ch. 1, 2, 18.	
Week 01	22 Sep - 28 Sep 2020	Overview 2, Virtualization & Scripting	Ch. 1, 2, 18.	
Week 02	29 Sep - 05 Oct 2020	Security, Protection, Privacy,	Ch. 16, 17	
		& C-language		
Week 03	06 Oct - 12 Oct 2020	File System & FUSE	Ch. 13, 14, 15	
Week 04	13 Oct - 19 Oct 2020	Addressing, Shared Lib, & Pointer	Ch. 9	
Week 05	20 Oct - 26 Oct 2020	Virtual Memory	Ch. 10	
Week 06	27 Oct - 16 Nov 2020	Concurrency: Processes & Threads	Ch. 3, 4	
	29 Oct 2020	Maulid Nabi		
Week 07	17 Nov - 23 Nov 2020	Synchronization & Deadlock	Ch. 6, 7, 8	
Week 08	24 Nov - 30 Nov 2020	Scheduling + W06/W07	Ch. 5	
Week 09	01 Dec - 07 Dec 2020	Storage, Firmware, Bootldr, & Systemd	Ch. 11	
Week 10	08 Dec - 16 Dec 2020	I/O & Programming	Ch. 12	
	09 Dec 2020	Pil Kada		

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 Extra Scele from Home https://scele.cs.ui.ac.id/course/view.php?id=3020. ■ Download Slides and Demos from GitHub.com https://github.com/UI-FASILKOM-OS/SistemOperasi/ □ **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). **Build your own Virtual Guest** https://osp4diss.vlsm.org/

Agenda

- Start
- 2 Schedule
- 3 Agenda
- 4 Week 08
- Scheduling
- 6 CPU Burst: How Long (When)?
- MultiProcessor Schedulling
- The Two State Model
- The End

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

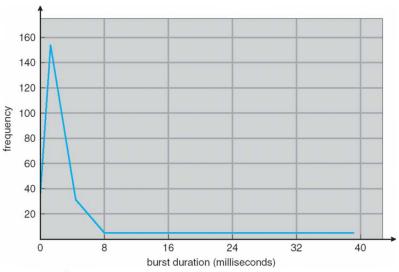
- Compare and contrast the common algorithms used for both preemptive and non-preemptive scheduling of tasks in operating systems, such as priority, performance comparison, and fair-share schemes. [Usage]
- Describe relationships between scheduling algorithms and application domains. [Familiarity]
- 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
 - $\bullet \ \, \text{User-level} \to \mathsf{Process\text{-}Contention} \ \, \mathsf{Scope} \ (\mathsf{PCS}) \text{: many to many/one}.$
 - $\bullet \ \, \mathsf{Kernel\text{-}level} \to \mathsf{System\text{-}Contention} \ \, \mathsf{Scope} \ (\mathsf{SCS}) \text{: one to one}.$
- Standard Linux Scheduling
 - Completely Fair Scheduler (CFS).
 - Real Time Scheduling.

CPU Burst: How Long (When)?



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MultiProcessor Schedulling

- Asymmetric Multiprocessing vs. Symmetric Multiprocessing (SMP).
- Processor Affinity: soft vs. hard.
- NUMA: Non-Uniform Memory Access.
- Load Balancing
- Multicore Processors
- Real Time Schedulling: 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: $p = 60\% \Rightarrow \text{CPU Utilization Per Process}$: $\left\lfloor \frac{1 (60\%)^n}{n} \right\rfloor$

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 processs, the CPU time will be 18 seconds.

The End

- ☐ This is the end of the presentation.
- extstyle ext
- This is the end of the presentation.