

# CSF2600505 Sistem Operasi CSGE602055 Operating Systems Week 00: Overview 1

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University of Indonesia

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

Always check for the latest revision!

REV256 17-Nov-2020

# Operating Systems 202<sup>3</sup>) — PJJ from HOME

## ZOOM: International [Tue 08-10] — A/Matrix [Tue 10-12]

Week	Schedule & Deadline <sup>1)</sup>	Topic	OSC10 <sup>2)</sup>
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, & C-language.	Ch. 16, 17.
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 29 Oct 2020	Concurrency: Processes & Threads Maulid Nabi	Ch. 3, 4.
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, Bootloader, & Systemd	Ch. 11.
Week 10	08 Dec - 16 Dec 2020	I/O & Programming	Ch. 12.
	09 Dec 2020	Pil Kada	

<sup>1)</sup> The **DEADLINE** of Week 00 is 21 Sep 2020, whereas the **DEADLINE** of Week 01 is 28 Sep 2020, and so on...

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

<sup>3)</sup> 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**, 10<sup>th</sup> Edition, 2018. See also <http://codex.cs.yale.edu/avi/os-book/OS10/>.
- **Resources**
  - **SCELE** — <https://scele.cs.ui.ac.id/course/view.php?id=3020>. 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).
- **Build your own Virtual Guest**  
<https://osp4diss.vlsm.org/>

# Agenda

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- 5 Assessment
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# Agenda (2)

- 15 Week 00
- 16 Week 01
- 17 Week 02
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# How to contact the Lecturer<sup>2</sup>

For Q & A, use WhatsApp Group **OperatingSystems**  
(info +62-881-456-XXXX)

Email (Subject:[**HELP**]) [operatingsystems@vlsm.org](mailto:operatingsystems@vlsm.org)  
State your "Name", "ID", and "OS class".

**SCELE** — (The enrollment key is **XXX**):  
<https://scele.cs.ui.ac.id/course/view.php?id=3020>.



Figure: Never ever whine and pretend like this<sup>1</sup>!

<sup>1</sup>"Puss in Boot" is a DreamWorks/Paramount Picture character.

<sup>2</sup>FYI: King Goerge II founded the University of Goettingen in 1734.

# Assessment

- **4 SKS** (Units) means 12 hours per week!
  - You need to log your weekly activities!
- **11** (weekly) assignments @ 11.11 points.
  - Assignments will vary from week to week.
  - The assignment deadline will be by the end of every week (see page 2).
  - See the check list at the end of this presentation.
- Final grade: the sum of the best 9 out of 11 assignments.

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85 - ... = A	80 - 85 = A-	75 - 80 = B+	70 - 75 = B
65 - 70 = B-	60 - 65 = C+	55 - 60 = C	50 - 55 = D or C <sup>1</sup>
40 - 50 = D	30 - 40 = E	20 - 30 = E	00 - 20 = E

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- **C-2C:** upto 5 points.
  - Only if your grade is between 50.00 and 55.00 and you have a "good" track record.
- Check your points regularly at <https://academic.ui.ac.id/> and **DO NOT COMPLAIN** weeks after! See also, <https://os.vlsm.org/>.

<sup>1</sup>Terms and Conditions apply. Void where prohibited by law.

# The Three-Strikes Rule



- All major academic-rules violations will be handled directly by the Faculty of Computer Science, University of Indonesia.
- "Accidents" may happen. There will be warnings for the first two minor violations.
- Your final grade will be reduced for the third warning.
- Your final grade will be reduced to "D" for the fourth warning.
- Five (5) or more warnings will be considered as a major academic-rules violation.



# AIN'T DIFFICULT, lah!



Source: GSGS

Figure: Even this Goat will get "C" at the end of the semester!

# Prelude: Daisy Bell – Bicycle Built for Two



Daisy, Daisy,  
Give me your answer, do!  
I'm half crazy,  
All for the love of you!  
It won't be a stylish marriage,  
I can't afford a carriage,  
But you'll look sweet on the seat  
Of a bicycle built for two!

See also [https://youtu.be/TXK\\_cE9AqAI](https://youtu.be/TXK_cE9AqAI).

# IBM 704 at Los Alamos National Laboratory in the 1950s



**IBM 704 ELECTRONIC DATA-PROCESSING MACHINES**

Estimate price (2020 value): USD 8,000,000.

Weight: 8800 kg — Electricity: ca. 200 kWatt — 42000 flops — 128 kbytes (eq.) core memory — 64 kbytes (eq.) drum memory — 3 Mbytes (eq.) Tape Unit.

# QS855, 256GB, 12 GB, 48+12 MP, 6.4", 4000 mAh

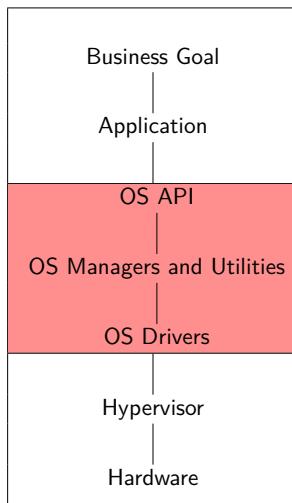


-  **AMOLED 6.39" FHD+**  
1080 x 2340 pixels
-  **48+12 Megapixel (Primary)**  
20 Megapixel (Selfie)
-  **Qualcomm Snapdragon 855 Plus (7 nm)**  
Android 9.0 (Pie)
-  **128 / 256 GB**  
8 / 12 GB RAM
-  **Li-Ion 4000 mAh**  
Fast Charging 27W

Estimate price (2020 value): Rp. 8,000,000.

# Week 00: Review

- What is an Operating System?
- Why taking an Operating System class?



# Remember Computer Organization (POK/DDAK)?

- You should understand:
  - von Neumann Model.
  - Buses, Bridges, Transfer Rate, Clock.
  - Memory: DDR, DDR-2, DDR-3 ...
  - Cache, Buffer, Spool, & Pipelining.
  - Direct Memory Access (DMA).
  - Port & Memory Mapped I/O.
  - CPU: (privilege/kernel/supervisor mode) vs. (user mode).
  - Physical (Hardware) Limitation.
  - Priority: Read vs Write.
  - Interrupts: Polling & Vectored.
  - Multiprocessors: Symmetric vs. Asymmetric.
  - Multicore & Multithreading.
  - Clustered Systems.
  - Numbers: base 2, base 8, base 10, base 16.
    - Base 2:  $110010101010_2$
    - Base 8:  $01234567_8 = 000\ 001\ 010\ 011\ 100\ 101\ 110\ 111_2$
    - Base 10:  $012\ 345\ 679$
    - Base 16:  $9AB\ CDEF_{16} = 1001\ 1010\ 1011\ 1100\ 1101\ 1110\ 1111_2$

# Can you read a Block Diagram?

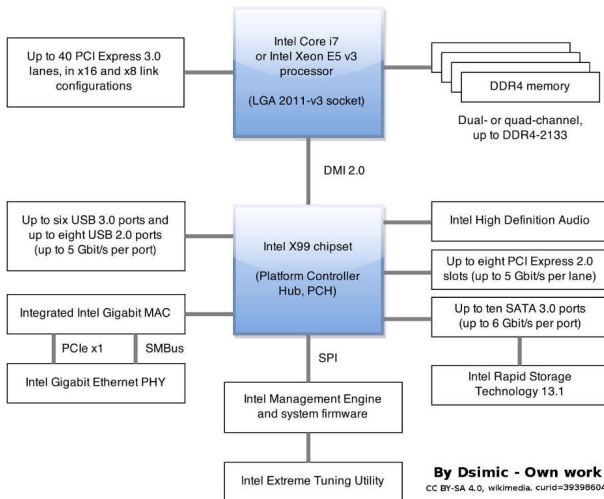


Figure: Block Diagram

# What is an APIC?!

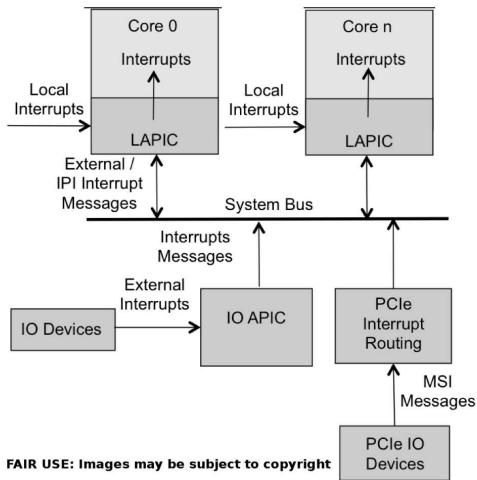
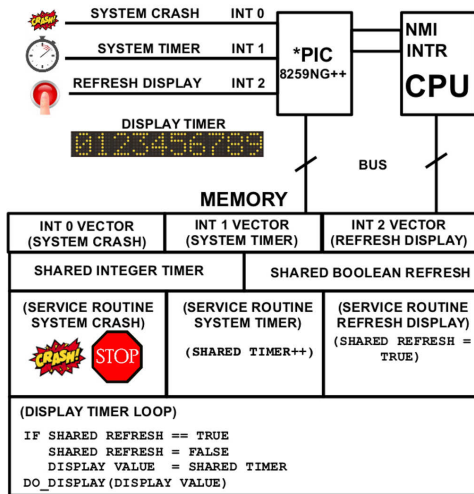


Figure: APIC (Advanced Programmable Interrupt Controller)



# And, what is "Interrupt Handling"?



(c) 2017 VauLSMorg – This is a free picture

Figure: Interrupt Handling with PIC (Programmable Interrupt Controller)

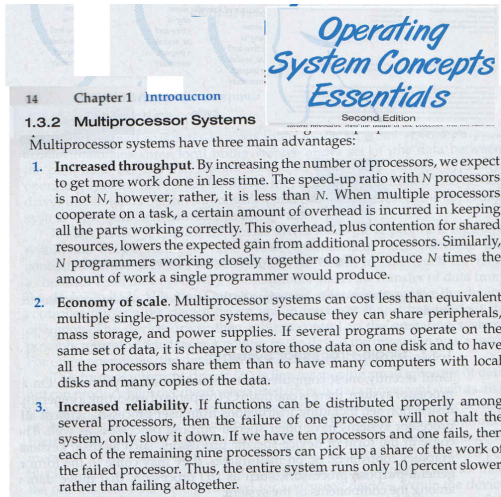
# The Operating System Managers

- Process Manager:
  - Creating/Deleting; Suspending/Resuming; Synchronization; Communication; Scheduling
- Memory Manager:
  - Tracking; Move In/Move Out; Allocating/Deallocating.
- Storage/File System Manager:
  - Create/Delete; Open/Close; Read/Write.
- Mass Storage Manager:
  - Scheduling; Allocating; Free Space.
- I/O Manager:
  - Buffering; Caching; Spooling.
  - Interfacing (driving).
- Protecting & Security Manager:
  - Protecting.
  - Security.

# Any idea, what these following terms mean?!

- Scripting: bash, regex, sed, awk
- Security and Protection
- File System
- Data Structure in a (logical) Memory
- Virtual Memory
- Concurrency
- Synchronization
- Mass Storage
- UEFI, GRUB, and systemd
- I/O
- I/O Programming

# Week 00: Problem Example (from OSC2e)



**Figure: T / F** The advantages of a multiprocessor system include: increased throughput, economy of scale, and increased reliability (Week 00 2016-1).

# Assignments

- There will no mid-term (UTS) nor final-term (UAS). Instead, there will be 11 weekly assignments. Your grade will be taken from the best 9 out of 11 assignments.
- Each assignment deadline will be by the end of that "week". The weekly schedule is always on page 2!
- Understand how to "**add, commit, and push**" will be an advantage. But, you are allowed to use the "github web interface" for the Week 00 assignment.
- Submit (push) the assignments to `github.com`. If you still don't have one, you need to sign up for a `github.com` account. More information will follow.
- There will be a "check list" at the end of this presentation.
- By popular demand, the weekly schedule will be repeated on the following page!

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- **Resources**
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  - **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).
- **Build your own Virtual Guest**  
<https://osp4diss.vlsm.org/>

# Week 00 Assignment #1: Public Repository "os202"

- Visit [github.com](https://github.com)

- (IF NO ACCOUNT) **SIGN UP** (<https://github.com/join>).
- (ELSE) **SIGN IN** (<https://github.com/login>).
- Create a new repository ("os202"):

The screenshot shows the GitHub 'Create new repository' form. Red arrows point to the following elements:

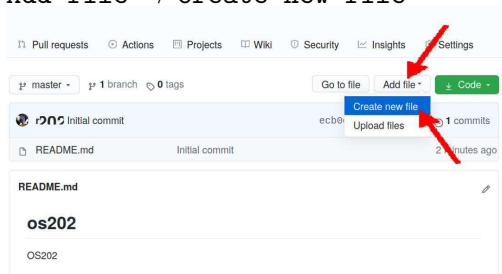
- Owner:** 'mou36' (indicated by a red arrow).
- Repository name:** 'os202' (indicated by a red arrow).
- Description (optional):** 'OS202' (indicated by a red arrow).
- Public/Private:** The 'Public' radio button is selected (indicated by a red arrow).
- Initialize this repository with:** The 'Add a README file' checkbox is checked (indicated by a red arrow).
- Default branch:** 'master' (indicated by a red arrow).
- Create repository:** The green button at the bottom (indicated by a red arrow).

- **Repository name:** "os202" (all small).
- **Public:** Anyone can see this repository.

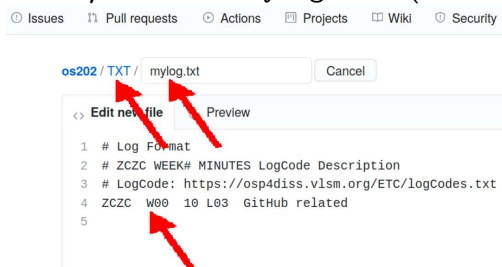


# Week 00 Assignment #2: Start Week 00 Log (1)

Add file → Create new file



**Folder/File:** "TXT/mylog.txt" (Eg. Week-00 10 minutes doing GitHub (L03))



# Week 00 Assignment #2: Start Week 00 Log (2)

## Commit a new file



### Commit new file

Create mylog.txt

Add an optional extended description...

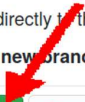
██████@vlsm.org

Choose which email address to associate with this commit

- ☒ Commit directly to the `master` branch.
- ☐ Create a **new branch** for this commit and start a pull request

Commit new file

Cancel



# Week 00 Assignment #3 & #4

- Assignment #3: Create Your GitHub Page
  - Do GSGS<sup>1</sup>. Find out how to create your GitHub Page!
  - Eg. if your GitHub account is "cbkadal" (Cicak Bin Kadal).
  - The GitHub repository will be:
    - <https://github.com/cbkadal/os202/>.
  - The GitHub Page will be:
    - <https://cbkadal.github.io/os202/>.
- Assignment #4: The Weekly TOP 10 LIST
  - **Read any** recent and decent Operating Systems TextBook chapter(s) that are related to this week topic.
  - Write a **TOP 10 LIST** about what points of this week that you think are important.
  - This Week 00 TOP 10 LIST will be merged with the TOP 10 LIST of Week 01.

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<sup>1</sup>Google Sana (There) Google Sini (Here)

# Week 00 Assignment #5: Course Registration

The screenshot shows a Google Form titled "Operating System Programming". It contains several required fields, each marked with a red asterisk and a red arrow pointing to it:

- Email address \***: A text input field with the placeholder "Your email".
- Class \***: A radio button selection with three options: ☐ OS\_MATRIX, ☐ OS\_REGULAR, and ☐ OS\_INTERNATIONAL.
- Student ID (NPM) \***: A text input field with the placeholder "Your answer".
- GitHub Account \***: A text input field with the placeholder "Your answer".
- Name (SIAK) \***: A text input field with the placeholder "Your answer".

At the bottom, there is a toggle switch for "Send me a copy of my responses." and a purple "Submit" button. A green progress bar indicates "Page 1 of 1". A footer note states: "Never submit passwords through Google Forms."

- You need a Google Account to fill this Google Form.
- The Google Form link will be available at **SCELE**.
- Fill in with the email address that you normally use. It does not have to be Gmail.
- GitHub Account example: "cbkadal".
- "github.com/cbkadal/" **is not** a GitHub account.
- Use your SIAK name, **NOT** your NICK name.
- If you make a mistake, just revisit the Google Form page.

# Course Highlights and Syllabus

## Coverage

This is an introduction to a modern operating systems course. It will cover general overview, computer architecture review, operating system overview, GNU/Linux CLI, scripting, C language overview, protection, security, privacy, systemd, I/O, addressing and pointers, memory management, processes and threads, virtual memory, synchronization, mutual exclusion, deadlock, CPU scheduling algorithms, file systems, and I/O programming.

## Student-Centered

This course is student-centered where responsibility is in the hands of the students. Students are expected to be prepared for the class meeting.

## GNU/Linux

Students will have a thorough understanding of how GNU/Linux provides services by using a Command Line Interface.

# Week 00 Overview I: Topics<sup>1</sup>

- Role and purpose of the operating system
- Functionality of a typical operating system
- Mechanisms to support client-server models, hand-held devices
- Design issues (efficiency, robustness, flexibility, portability, security, compatibility)
- Influences of security, networking, multimedia, windowing systems
- Structuring methods (monolithic, layered, modular, micro-kernel models)
- Abstractions, processes, and resources
- Concepts of application program interfaces (APIs)
- The evolution of hardware/software techniques and application needs
- Device organization
- Interrupts: methods and implementations
- Concept of user/system state and protection, transition to kernel mode

---

<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 00 Overview I: Learning Outcomes (1)<sup>1</sup>

- Explain the objectives and functions of modern operating systems [Familiarity]
- Analyze the tradeoffs inherent in operating system design [Usage]
- Describe the functions of a contemporary operating system with respect to convenience, efficiency, and the ability to evolve. [Familiarity]
- Discuss networked, client-server, distributed operating systems and how they differ from single user operating systems. [Familiarity]
- Identify potential threats to operating systems and the security features design to guard against them. [Familiarity]
- Explain the concept of a logical layer. [Familiarity]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 00 Overview I: Learning Outcomes (2)<sup>1</sup>

- Explain the benefits of building abstract layers in hierarchical fashion. [Familiarity]
- Describe the value of APIs and middleware. [Assessment]
- Describe how computing resources are used by application software and managed by system software. [Familiarity]
- Contrast kernel and user mode in an operating system. [Usage]
- Discuss the advantages and disadvantages of using interrupt processing. [Familiarity]
- Explain the use of a device list and driver I/O queue. [Familiarity]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013



# Week 01 Overview II: Topics<sup>1</sup>

- Types of virtualization (including Hardware/Software, OS, Server, Service, Network)
- Paging and virtual memory
- Virtual file systems
- Hypervisors
- Portable and cost of virtualization; emulation vs. isolation
- Cloud services: IAAS, PAAS and Platform APIs, SAAS
- Introduction to Scripting and REGEX.

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 01 Overview II: Learning Outcomes<sup>1</sup>

- Explain the concept of virtual memory and how it is realized in hardware and software. [Familiarity]
- Discuss hypervisors and the need for them in conjunction with different types of hypervisors. [Usage]
- Differentiate emulation and isolation. [Familiarity]
- Evaluate virtualization trade-offs. [Assessment]
- Discuss the importance of elasticity and resource management in cloud computing. [Familiarity]
- Explain the advantages and disadvantages of using virtualized infrastructure. [Familiarity]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 02 Security & Protection: Topics<sup>1</sup>

- Overview of system security
- Policy/mechanism separation
- Security methods and devices
- Protection, access control, and authentication
- Backups

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 02 Security & Protection: Learning Outcomes<sup>1</sup>

- Articulate the need for protection and security in an OS (cross-reference IAS/Security Architecture and Systems Administration/Investigating Operating Systems Security for various systems). [Assessment]
- Summarize the features and limitations of an operating system used to provide protection and security [Familiarity]
- Explain the mechanisms available in an OS to control access to resources [Familiarity]
- Carry out simple system administration tasks according to a security policy, for example creating accounts, setting permissions, applying patches, and arranging for regular backups [Usage]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 03 File System & FUSE: Topics<sup>1</sup>

- Files: data, metadata, operations, organization, buffering, sequential, nonsequential
- Directories: contents and structure
- File systems: partitioning, mount/unmount, virtual file systems
- Standard implementation techniques
- Memory-mapped files
- Special-purpose file systems
- Naming, searching, access, backups
- Journaling and log-structured file systems

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 03 File System & FUSE: Learning Outcomes<sup>1</sup>

- Describe the choices to be made in designing file systems.  
[Familiarity]
- Compare and contrast different approaches to file organization, recognizing the strengths and weaknesses of each. [Usage]
- Summarize how hardware developments have led to changes in the priorities for the design and the management of file systems.  
[Familiarity]
- Summarize the use of journaling and how log-structured file systems enhance fault tolerance. [Familiarity]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 04 Addressing: Topics<sup>1</sup>

- Bits, bytes, and words
- Numeric data representation and number bases
- Representation of records and arrays

---

<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 04 Addressing: Learning Outcomes<sup>1</sup>

- Explain why everything is data, including instructions, in computers. [Familiarity]
- Explain the reasons for using alternative formats to represent numerical data. [Familiarity]
- Describe the internal representation of non-numeric data, such as characters, strings, records, and arrays. [Familiarity]

---

<sup>1</sup>Source: ACM IEEE CS Curricula 2013



# Week 05 Virtual Memory: Topics<sup>1</sup>

- Review of physical memory and memory management hardware
- Virtual Memory
- Caching
- Memory Allocation
- Memory Performance
- Working sets and thrashing

---

<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 05 Virtual Memory: Learning Outcomes<sup>1</sup>

- Explain memory hierarchy and cost-performance trade-offs. [Familiarity]
- Summarize the principles of virtual memory as applied to caching and paging. [Familiarity]
- Describe the reason for and use of cache memory (performance and proximity, different dimension of how caches complicate isolation and VM abstraction). [Familiarity]
- Defend the different ways of allocating memory to tasks, citing the relative merits of each. [Assessment]
- Evaluate the trade-offs in terms of memory size (main memory, cache memory, auxiliary memory) and processor speed. [Assessment]
- Discuss the concept of thrashing, both in terms of the reasons it occurs and the techniques used to recognize and manage the problem. [Familiarity]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 06 Concurrency: Topics<sup>1</sup>

- States and state diagrams
- Structures (ready list, process control blocks, and so forth)
- Dispatching and context switching
- The role of interrupts
- Managing atomic access to OS objects
- Implementing synchronization primitives
- Multiprocessor issues (spin-locks, reentrancy)

---

<sup>1</sup>Source: ACM IEEE CS Curricula 2013

## Week 06 Concurrency: Learning Outcomes (1)<sup>1</sup>

- Describe the need for concurrency within the framework of an operating system. [Familiarity]
- Demonstrate the potential run-time problems arising from the concurrent operation of many separate tasks. [Usage]
- Summarize the range of mechanisms that can be employed at the operating system level to realize concurrent systems and describe the benefits of each. [Familiarity]
- Explain the different states that a task may pass through and the data structures needed to support the management of many tasks. [Familiarity]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

## Week 06 Concurrency: Learning Outcomes (2)<sup>1</sup>

- Summarize techniques for achieving synchronization in an operating system (e.g., describe how to implement a semaphore using OS primitives). [Familiarity]
- Describe reasons for using interrupts, dispatching, and context switching to support concurrency in an operating system. [Familiarity]
- Create state and transition diagrams for simple problem domains. [Usage]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 07 Synchronization & Deadlock: Topics<sup>1</sup>

- Shared Memory and Critical Section
- Consistency, and its role in programming language guarantees for data-race-free programs
- Message passing: PtPo vs Multicast, Blocking vs non-blocking, buffering.

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 07 Synchronization & Deadlock: Learning Outcomes<sup>1</sup>

- Use mutual exclusion to avoid a given race condition. [Usage]
- Give an example of an ordering of accesses among concurrent activities (e.g., program with a data race) that is not sequentially consistent. [Familiarity]
- Use semaphores to block threads [Usage]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 08 Scheduling: Topics<sup>1</sup>

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

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013



# Week 08 Scheduling: Learning Outcomes<sup>1</sup>

- 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]

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 09 Storage, Firmware, Bootloader, & Systemd: Topics<sup>1</sup>

- Storage
- Storage Arrays
- BIOS
- Loader
- Systemd

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 09 Storage, Firmware, Bootloader, & Systemd: Learning Outcomes<sup>1</sup>

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

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 10 I/O & Programming: Topics<sup>1</sup>

- Characteristics of serial and parallel devices
- Abstracting device differences
- Buffering strategies
- Direct memory access
- Recovery from failures
- I/O Programming
- Network Programming

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<sup>1</sup>Source: ACM IEEE CS Curricula 2013

# Week 10 I/O & Programming: Learning Outcomes<sup>1</sup>

- Explain the key difference between serial and parallel devices and identify the conditions in which each is appropriate. [Familiarity]
- Identify the relationship between the physical hardware and the virtual devices maintained by the operating system. [Usage]
- Explain buffering and describe strategies for implementing it. [Familiarity]
- Differentiate the mechanisms used in interfacing a range of devices (including hand-held devices, networks, multimedia) to a computer and explain the implications of these for the design of an operating system. [Usage]
- Describe the advantages and disadvantages of direct memory access and discuss the circumstances in which its use is warranted. [Usage]
- Identify the requirements for failure recovery. [Familiarity]
- Implement a simple device driver for a range of possible devices. [Usage]
- I/O Programming [Usage]
- Network Programming [Usage]

# Week 00: Summary

- What is an Operating Systems?
  - Definition: Resource Allocator & Control Program.
  - Why taking an Operating System class?
- Computer Organization Review
- The Manager Set
  - Process Manager, Memory Manager, I/O Manager, Storage Manager.
- Security and Protection
- Virtualization
  - Hypervisor type 0, 1, 2
  - Paravirtualization, Emulators, Containers.
  - VCPU: Virtual CPU
  - Virtualization Implementation:
    - Trap-and-Emulate mode
    - Binary Translation mode

# TIPS (1)

- For any administrative issues, contact SEKRE at building B, 2<sup>nd</sup> floor – especially for absences, illness, sick letters, follow-up exams, etc. Please do not contact the **Lecturer** (RMS).
- Please complete the follow-up / paper work within 6 working days (RMS).
- Prepare the weekly MEMO as completely as possible. You should have mastered the material at the beginning of the week (RMS).
- Study the Operating System Concept book which deals with the material will be discussed that week (MIM). Make a summary of material in your Memo (IP).
- You should understand every single problem of the past examinations. Write down all hints in your "**MEMO**" (MHP).
- You are allowed to bring up to 6 sheets of MEMOs for the midterm (UTS) and up to 5 sheets of MEMOs for the final term (UAS) (RMS).
- You should understand every single line of the "**DEMOS**" (MHP).

## TIPS (2)

- You should ask **the lecturer** or anyone, anything you do not understand (TA).



# Special Thanks

**Special thanks** for the early version of this writing to:

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See also <https://rms46.vlsm.org/2/221.pdf>.

# Week 00: Check List (Deadline: Monday, 21-Sep-2020).

- ☐ Visit **Pengumuman Akademis**: <https://scele.cs.ui.ac.id/>
- ☐ Check this out:
  - ☐ **Starting Point**: <https://os.vlsm.org/>
  - ☐ **SCELE**: <https://scele.cs.ui.ac.id/course/view.php?id=3020>
  - ☐ **OSP4DISS**: <https://osp4diss.vlsm.org/>
- ☐ Week 00: Assignment (more details in **os00.pdf**).
  - ① Create GitHub Public Repository "os202".
  - ② Start Week 00 Log.
  - ③ Create your "os202" GitHub Page.
  - ④ Write a **TOP 10 LIST** about what points that you think are important. This Week 00 TOP 10 LIST will be merged with the TOP 10 LIST of Week 01.
  - ⑤ Course Registration (check **SCELE**).
- ☐ The "Assignment Day" is every Thursday morning.
- ☐ Revisit/add your own Weekly Log.
- ☐ **Study Hard!** No more TABULA RASA. Jolan Tru!
- ☐ This page is <https://os.vlsm.org/Slides/check00.pdf>.

# The End

- ☐ This is the end of the presentation.
- ☒ This is the end of the presentation.
  - This is the end of the presentation.