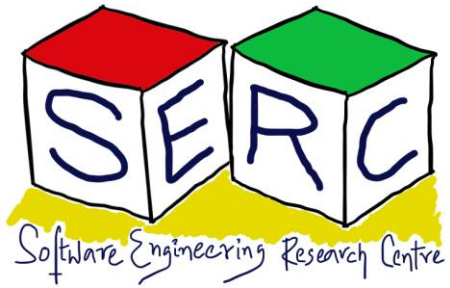
CS6.201 - Introduction to Software Systems

Spring 2025

https://sai11101989.github.io/cs6201_iss_spring2025.html



Who are we?

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Research Interests: Software Engineering, Virtual Reality, HCI

https://sai11101989.github.io

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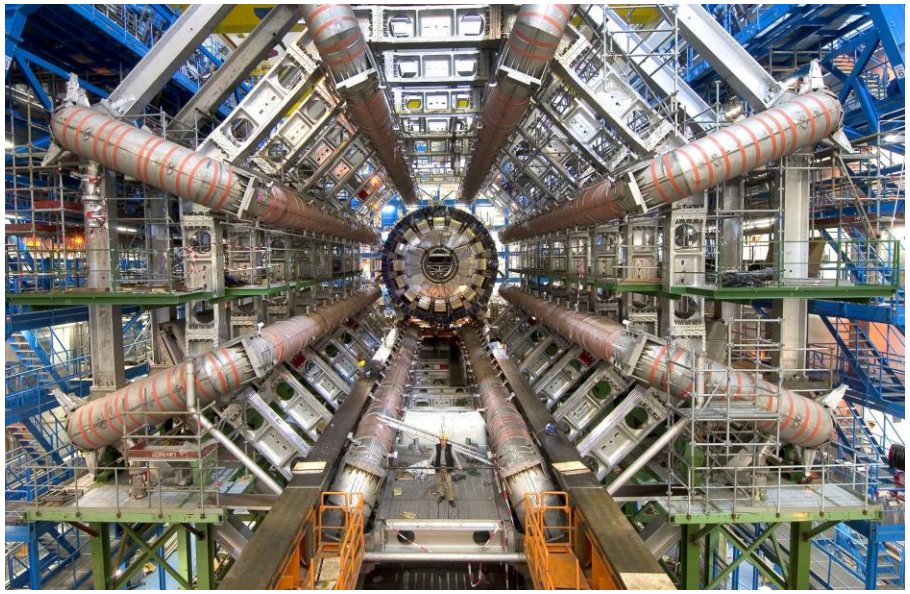
Academic Honesty

- A helps B in task X
  - B doesn't get opportunity to do task X
  - B doesn't learn the skill to do task X
  - B gets spoilt, dependent and unfit for jobs requiring skills of X
  - You may think it is okay to do it only once and not repeat it. But when a thing is done once, it gets wired into the brain as being “okay”; and unless there is a strong reason, it will repeat.
- If you want to help, help to learn.

What are common in these?

They are large complex "systems" with *lot* of software & hardware.

- The Boeing 777 flies with over 5,000,000 lines of code onboard.
- A typical top-level game has between 1 and 2 M SLOC (source lines of code)
- Thousands of devices



Programs

Teamwork

Process

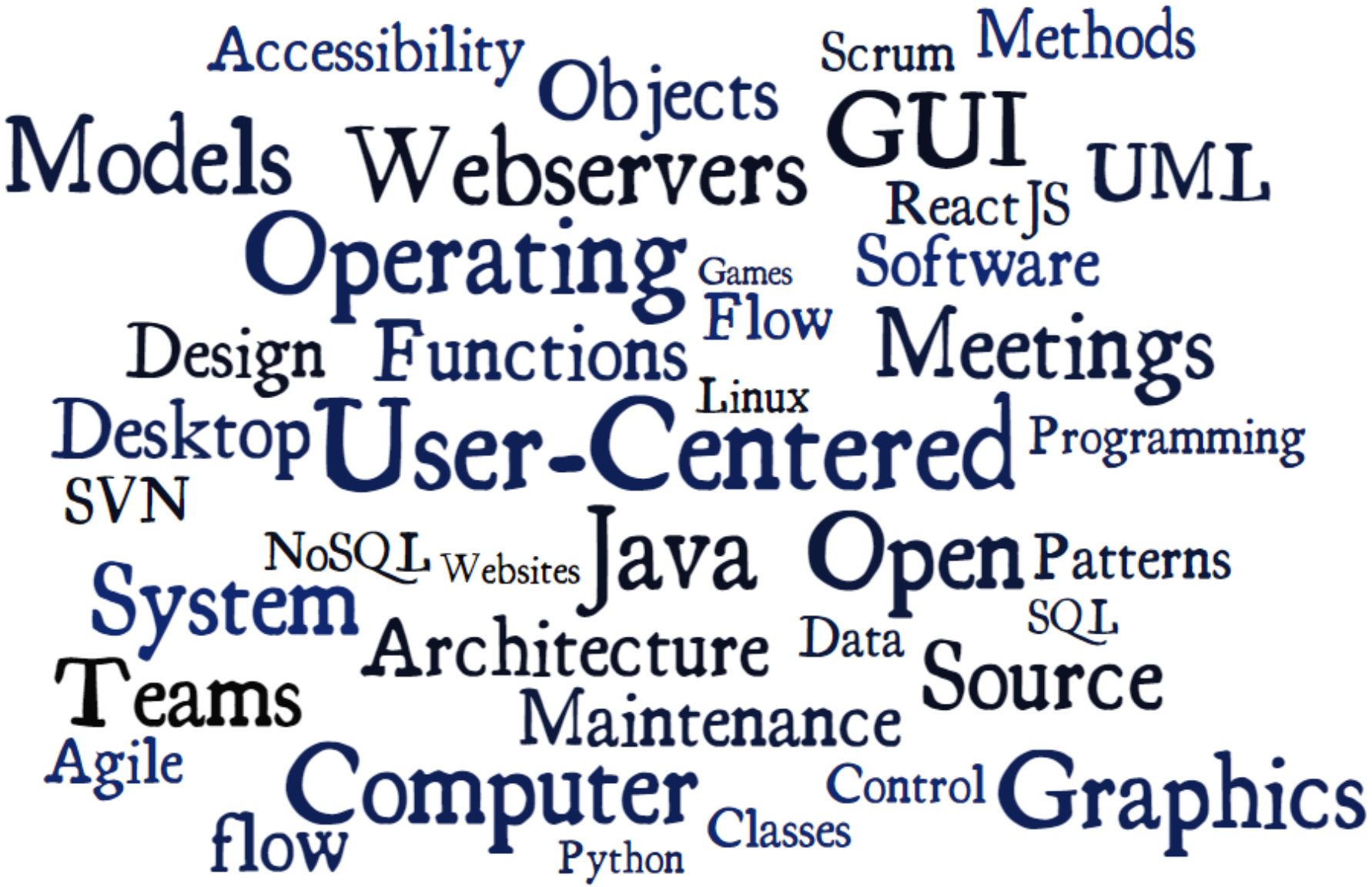
Communication

Engineering Design

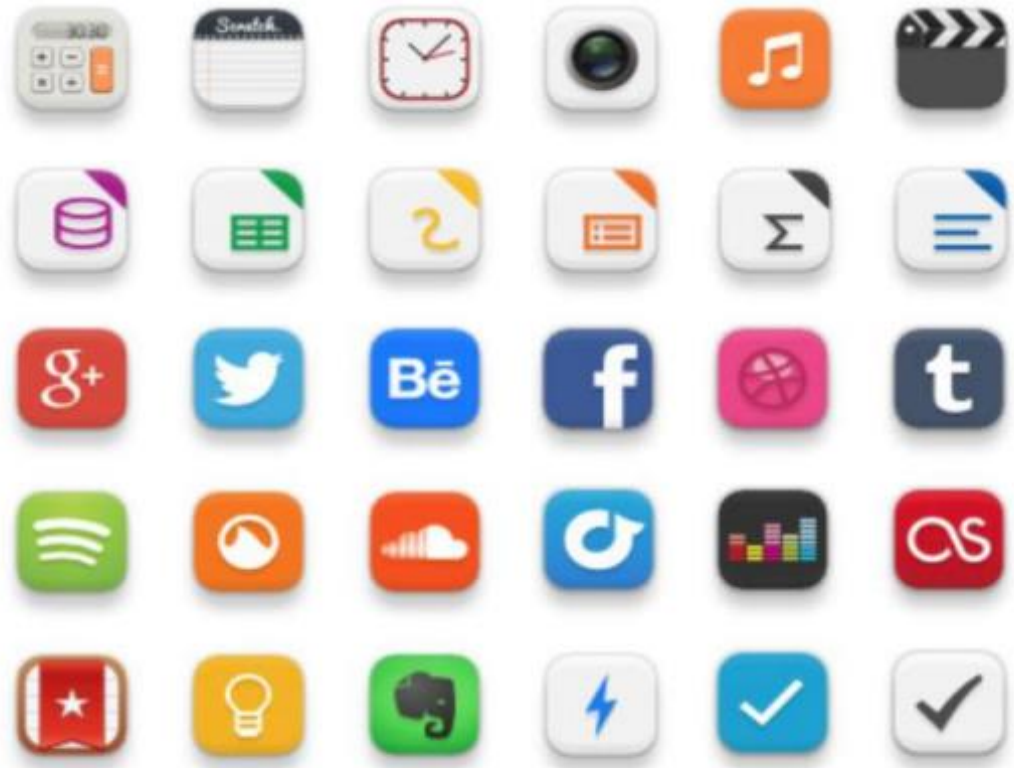
What is a System?

- Commonly used/understood definition
  - Set of inter-related components working together to achieve a common objective
- A system may be “natural” or “Engineered”
  - Solar System (Natural)
  - Telephone network system, power plants etc. (Engineered)
  - Systems have boundaries – due to various reasons

This course is all about…!



HARDWARE

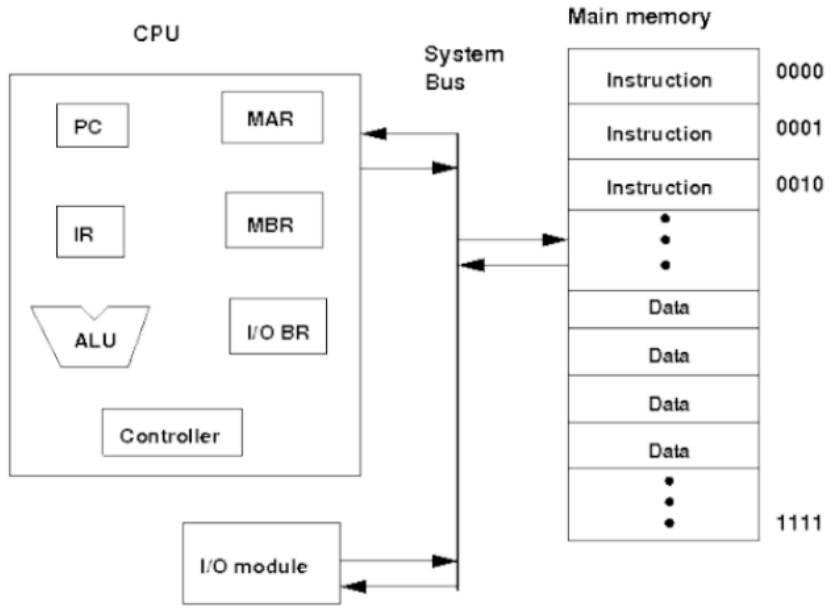


SOFTWARE

HARDWARE

Requirements of Basic Computing Device

- Input & Output Unit
- Memory Unit {primary, secondary}
- Processing Unit – {ALU, CU, Registers}
- Interconnection Structures – {control, address & data buses}

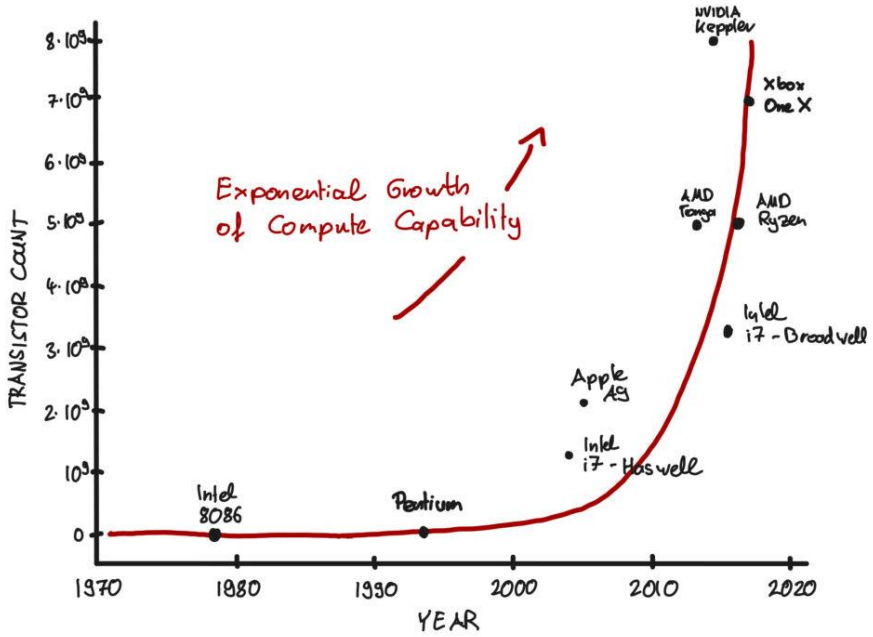


Ingredients of a Better Computation Power

- Organization of Hardware
- Mode of Processing
- Data Storage
- Processing Speed
- Complexity
- Control Mechanism
- Resilience

[MOORE'S LAW]
An observation that the number of transistors on a microchip roughly doubles every two years, whereas its cost is halved over the same timeframe

Gordon Moore (1929-2023)



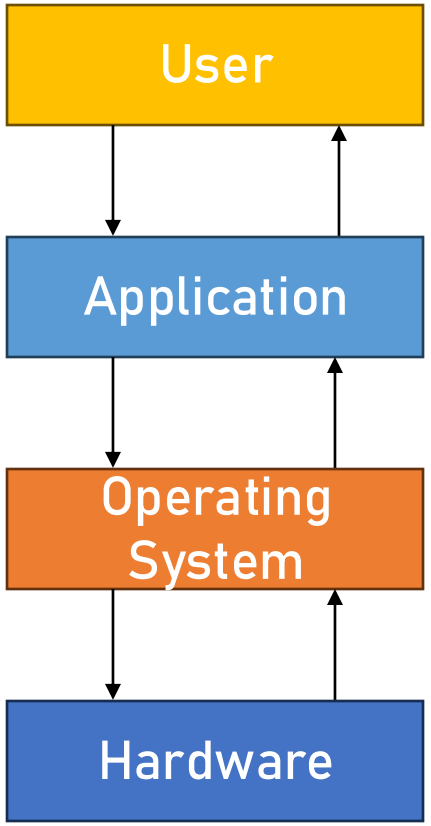
SOFTWARE

Software – A set of programs, procedures, algorithms and its documentation. It is written using programming languages

- *High-Level Languages* – e.g. C, C++, Java etc.
- *Assembly Language* – mnemonic-based e.g. ADD, SUB, MOV
- *Low-Level Language* – native language of computer circuitry

Language – has Syntactic + Semantic rules, otherwise called as Syntax, logical and/or runtime errors

Types – Complied Languages Vs Interpreted Languages Usage – Application Software Vs System Software

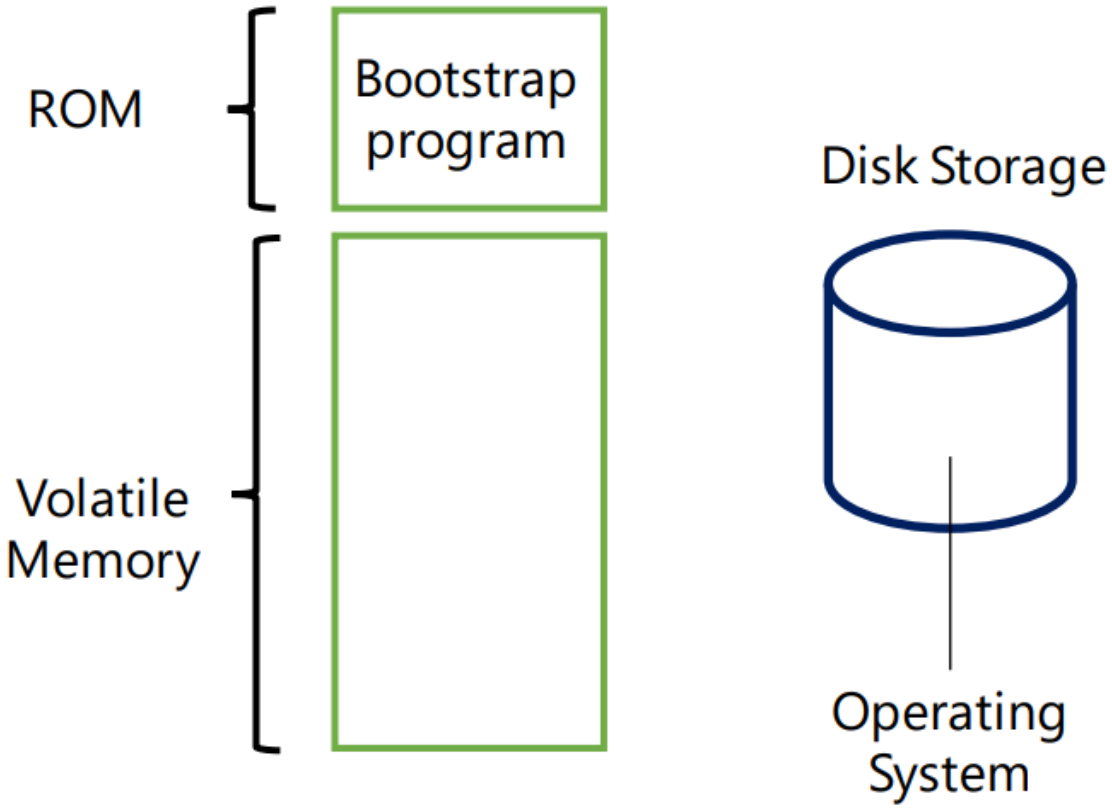


Operating System – A set of Software that manages computer hardware resources and serves other programs. It is a low-level software that supports a computer's basic functions, such as scheduling tasks and controlling peripherals.

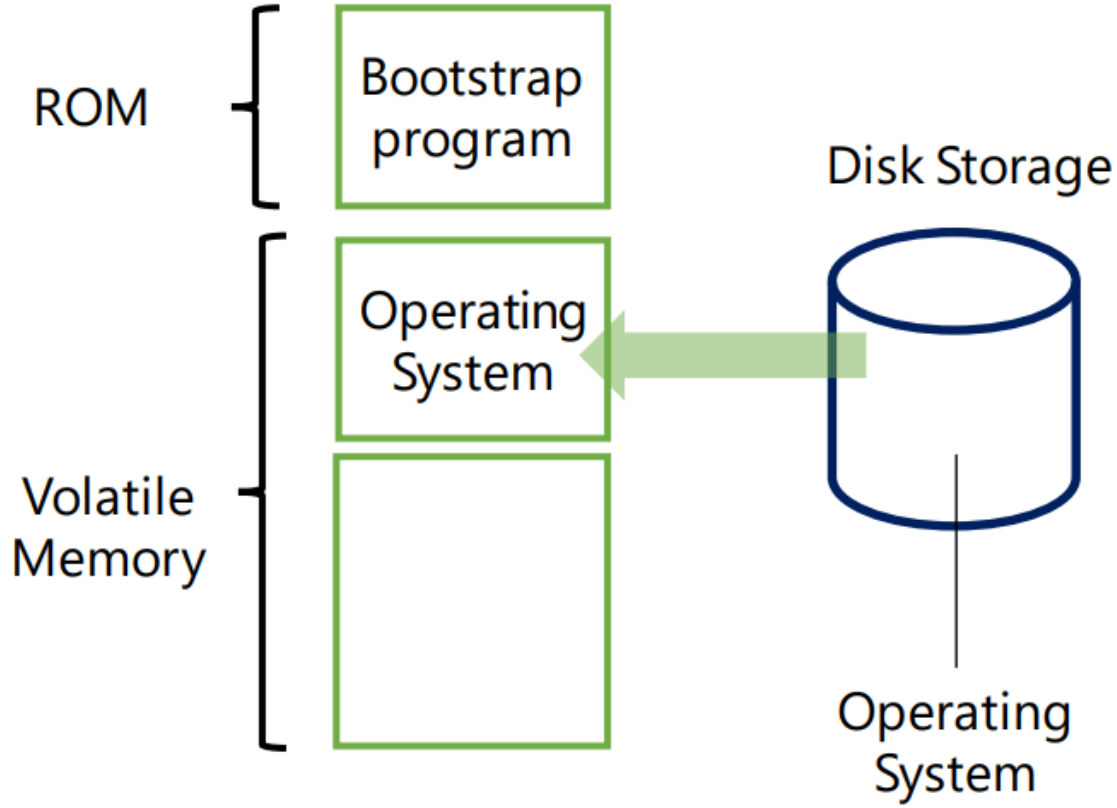
Examples – Windows, Unix, BSD, Linux, OS X, iOS, ChromeOS, Android etc.

Memory - Computer memory is any physical device capable of storing information temporarily or permanently. RAM (Random Access Memory) is an example for temporary memory whereas ROM (Read only Memory) is an example for permanent memory

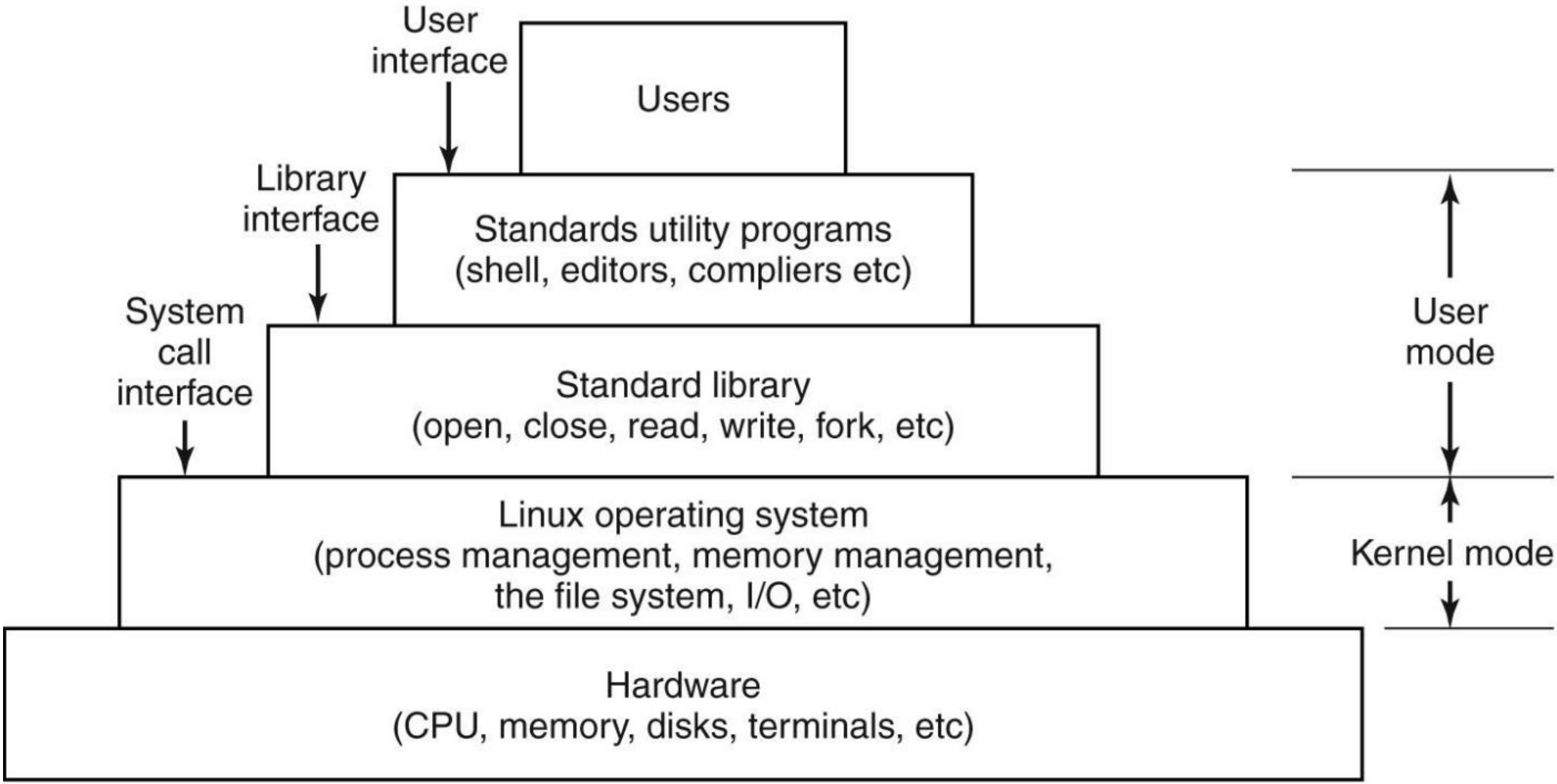
Did you know? – A Modern Smart Phone is 320,000,000 times "more powerful" than the ENIAC
https://www.quora.com/How-many-ENIAC-computers-would-fit-into-an-iPhone



Step 1 – Machine starts by executing the bootstrap program already in ROM. Operating System is stored in Mass Storage (Disk Storage)



Step 2 – Bootstrap program directs the transfer of the operating system into main memory and then transfers control to it


User interface
Users
Library interface
Standards utility programs (shell, editors, compliers etc)
System call interface
Standard library (open, close, read, write, fork, etc)
Linux operating system (process management, memory management, the file system, I/O, etc)
Hardware (CPU, memory, disks, terminals, etc)
User mode
Kernel mode

SHELL - A program (a.k.a. command-line interpreter) that allows the user to interact with the UNIX/Linux system. https://ss64.com/bash/

Examples: Bourne shell (sh), Bourne again shell (Bash), C shell (csh, tcsh), Korn shell (ksh), Powershell (windows)