Hello world!

오상준

DEEP BIO

Hardware

CPUs

RAMs, SSDs and HDDs

Others

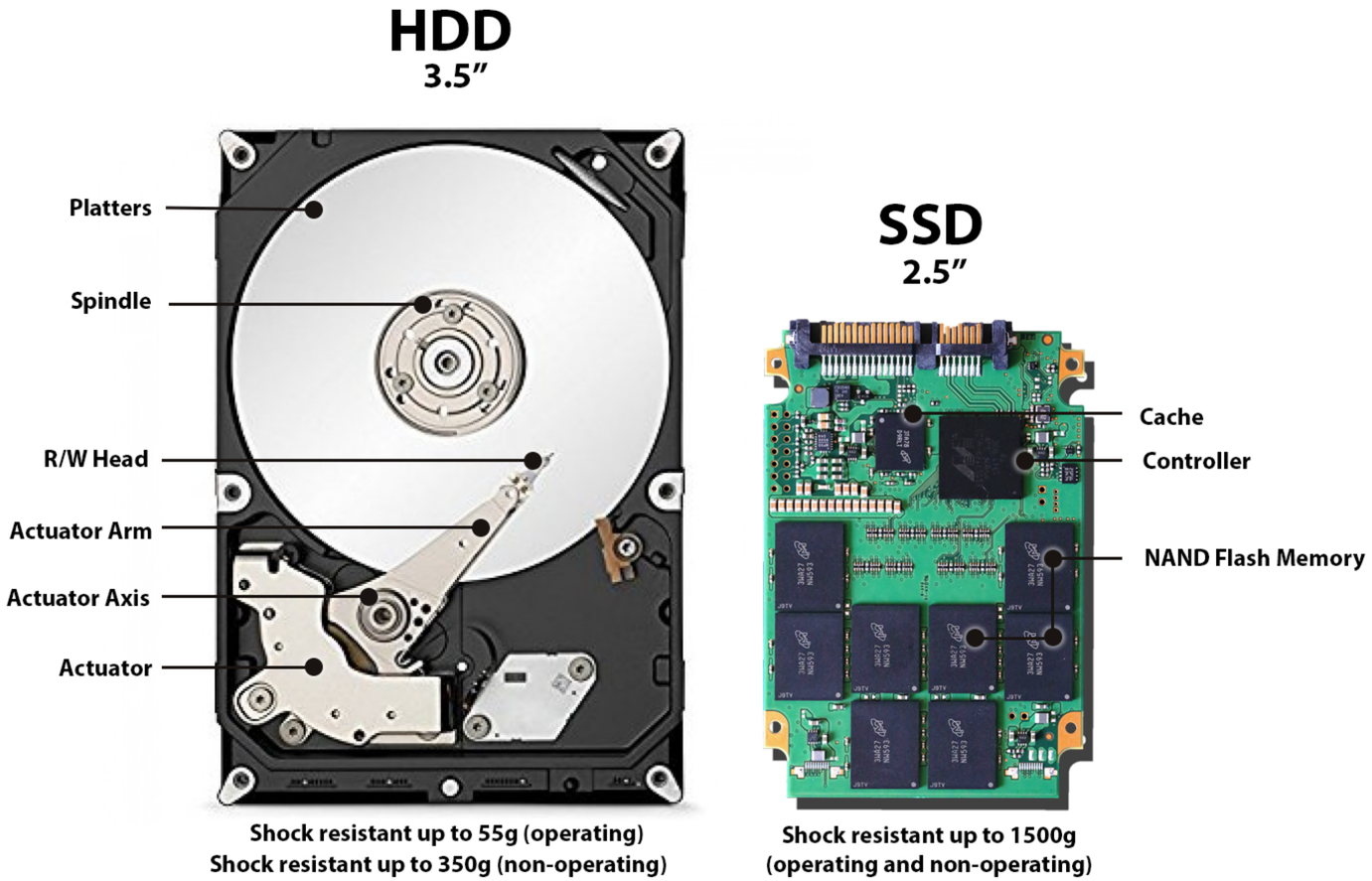
DEEP BIO

CPUs

- Cores and hyperthreading
- Clock rate: 4Ghz power wall
- Instruction sets: x86(Intel), x86-64(AMD), RISC(ARM)
- Caches: L1-L3

https://www.gearbest.com/cpu/pp_624000.html

RAMs, SSDs, and HDDs

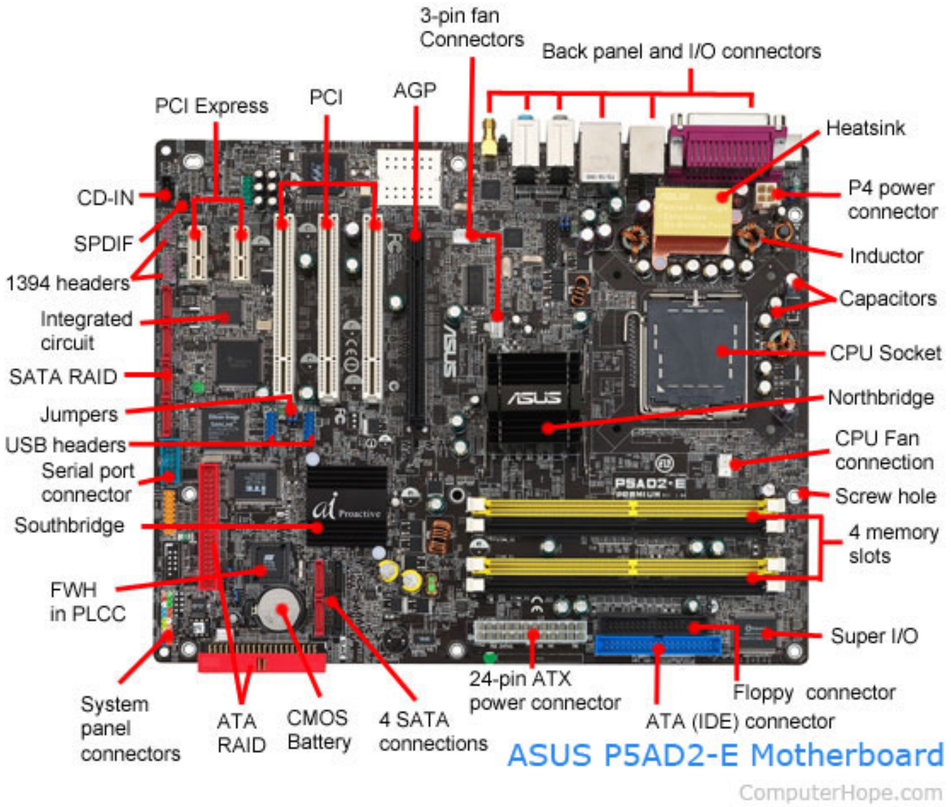


System Event	Actual Latency	Scaled Latency
One CPU cycle	0.4 ns	**1 s**
Level 1 cache access	0.9 ns	**2 s**
Level 2 cache access	2.8 ns	**7 s**
Level 3 cache access	28 ns	**1 min**
Main memory access (DDR DIMM)	~100 ns	**4 min**
Intel Optane memory access	<10 µs	**7 hrs**
NVMe SSD I/O	~25 µs	**17 hrs**
SSD I/O	50–150 µs	**1.5–4 days**
Rotational disk I/O	1–10 ms	**1–9 months**
Internet call: San Francisco to New York City	65 ms[3]	**5 years**
Internet call: San Francisco to Hong Kong	141 ms[3]	**11 years**

https://www.backblaze.com/blog/ssd-vs-hdd-future-of-storage/
https://www.prowesscorp.com/computer-latency-at-a-human-scale/

Others

- The mainboard (motherboard)
- Graphical Processing Units (GPUs)
- Power supply



https://www.computerhope.com/jargon/m/mothboar.htm

Software

Operating Systems (OS)

The kernel and the shell

Processes and threads

Programming languages

02

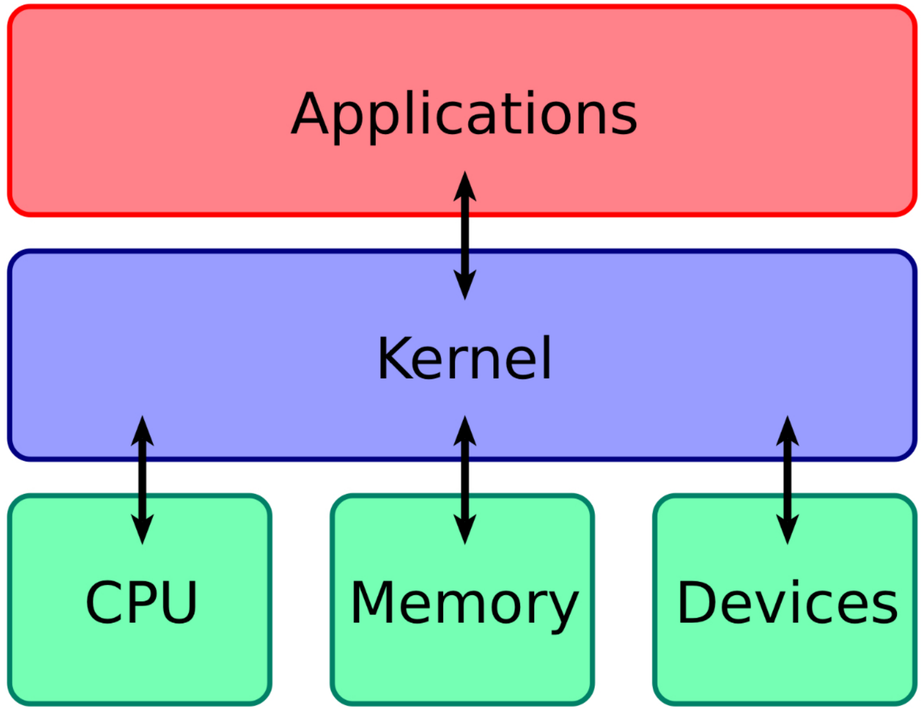
DEEP BIO

Operating Systems (OS)

- UNIX (IEEE standard POSIX-compliant)
  - FreeBSD, macOS, ...
- UNIX-like
  - Linux (Ubuntu, Ubuntu GNOME, CentOS, RHEL, ...)
- Windows

The kernel and the shell

- The kernel
  - resource management
  - process scheduling
  - user permissions



The kernel and the shell

- The shell
  - Command Line Interface (CLI)
    - sh, bash, zsh, csh, fish, ...
    - terminal emulators: Gnome terminal, iTerm2, Putty, ...
  - Graphical User Interface
    - Linux: X11 + desktop environment (GNOME, Unity, KDE, Xfce, ...)

The kernel and the shell

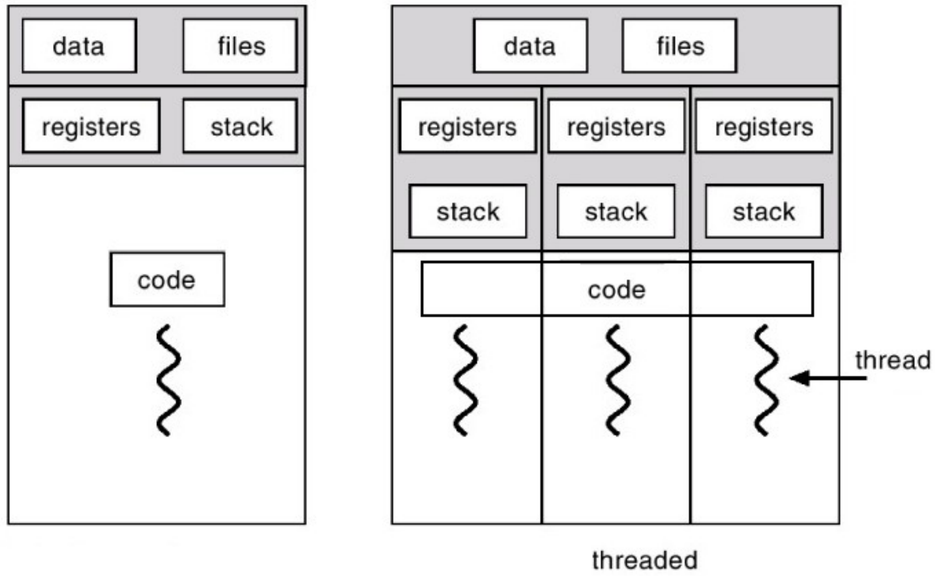
- 만화로 배우는 리눅스 시스템 관리

```
man, ls -lah, cd, cp, mv, rename, find -name -maxdepth -exec, mount,
ssh, scp, ln -s, cat, head, tail -f, wc -l, sort, uniq, comm, grep -irv,
cut -d -f, sed, top, ps -ef, jobs, fg, bg, kill, pkill, history, less,
vi, tar -cf -xf, xargs -I -P, tmux
```

Processes and threads

$$threads \in processes$$

- A process has 1 or more threads
- A core executes 1 thread at a time
- Threads of the same process share address space
- Processes need Inter-Process Communications (IPC) to talk to each other



http://www.cs.miami.edu/home/visser/Courses/CSC322-09S/Content/UNIXProgramming/UNIXThreads.shtml

Programming languages

- Compiled (C, C++, Go) and interpreted languages (Java, Python, Javascript)
  - Virtual Machines (VM)
  - Just-In-Time compiling
  - Garbage Collection (GC)
    - Python's Global Interpreter Lock (GIL)
- Paradigms
  - Object-Oriented Programming
  - Functional Programming