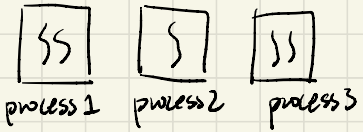
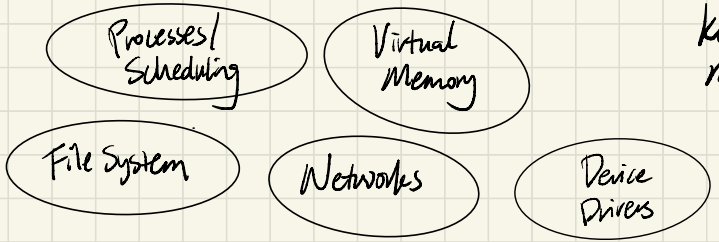
11/30 OS Structures



user mode

kernel mode



→ so far all the OS components we've learned runs in kernel mode

↳ OS = kernel

monolithic kernel

↳ all components share the same address space & same failure domain

How can we make kernel more reliable?

① Modularize it so that when one component fails the entire kernel doesn't crash

② Use programming languages with stronger promises.

→ rust guarantees memory safety (no data races)

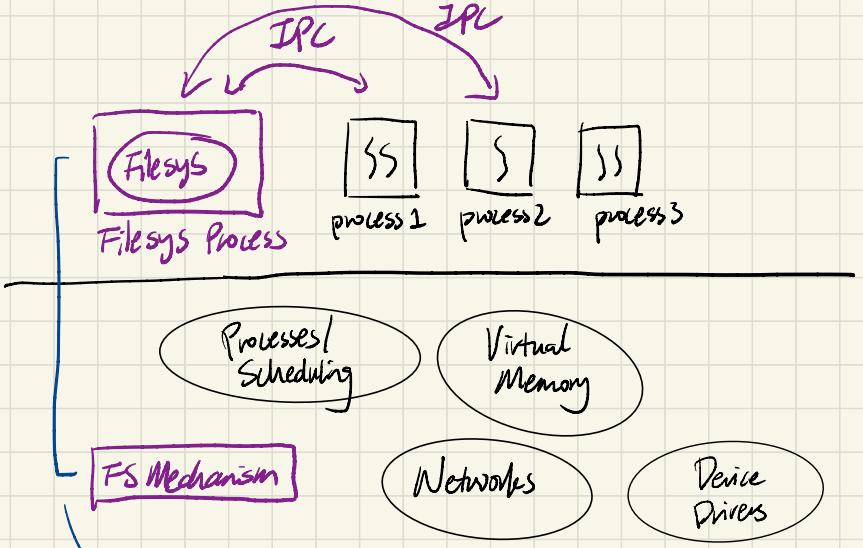
How do we isolate fault for each component? Process is a unit of fault domain, so maybe move each component into their own user process!

☆ What are some challenges if we move an OS component into a user process?

1). Availability
→ What if the fs process terminates? no one can use filesys anymore?

2). Communication
→ How do we request service from the fs process? IPC?
↳ lots of IPC = high overhead

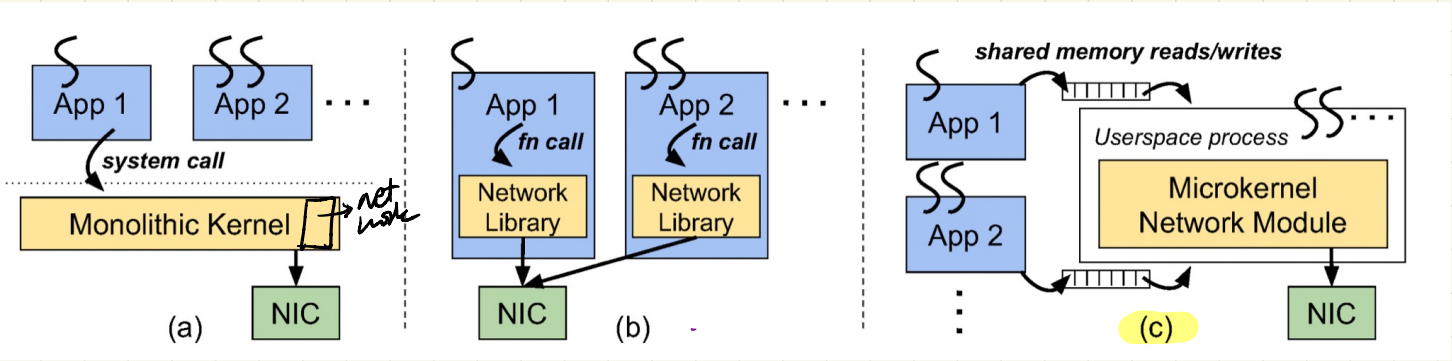
3). Access Permission
→ Access to certain HW still requires us to be in the kernel mode!
↳ needs both a kernel part for privileged access & a user process part for policies & designs



→ can do this for other OS components as well!
→ this approach is called microkernel

Keeps the kernel small & implement most OS components in user space.

Example of Microkernel in use = Google's Snap



→ based off of Linux, moves network stack into a userspace process!

https://research.google/pubs/pub48630/