

Operating Systems Overview

Instructor: Kartik Gopalan

Class website:

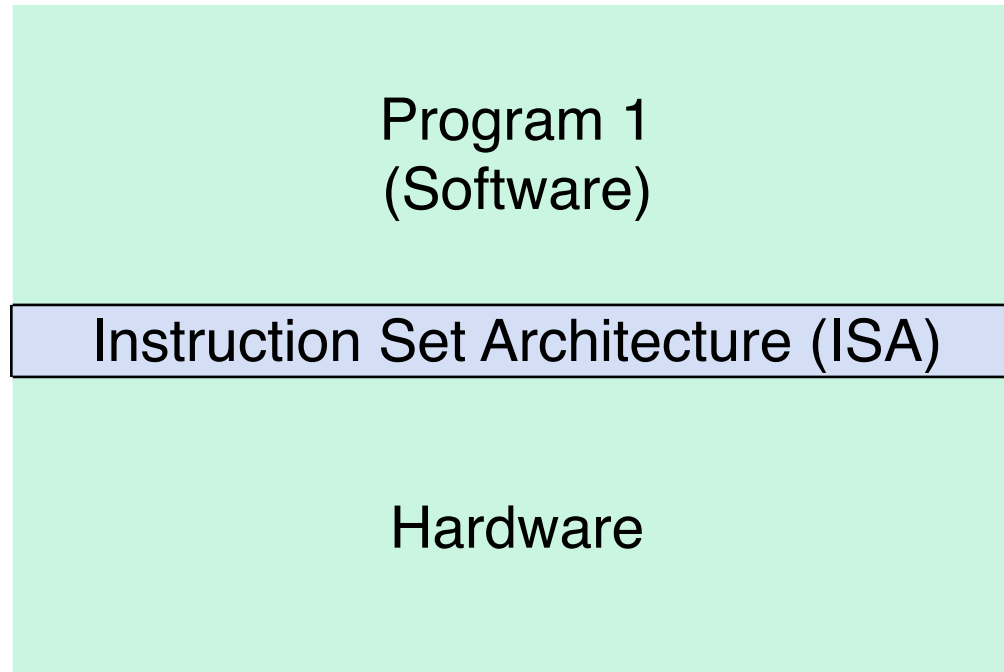
<http://oscourse.github.io>

What is an Operating System?

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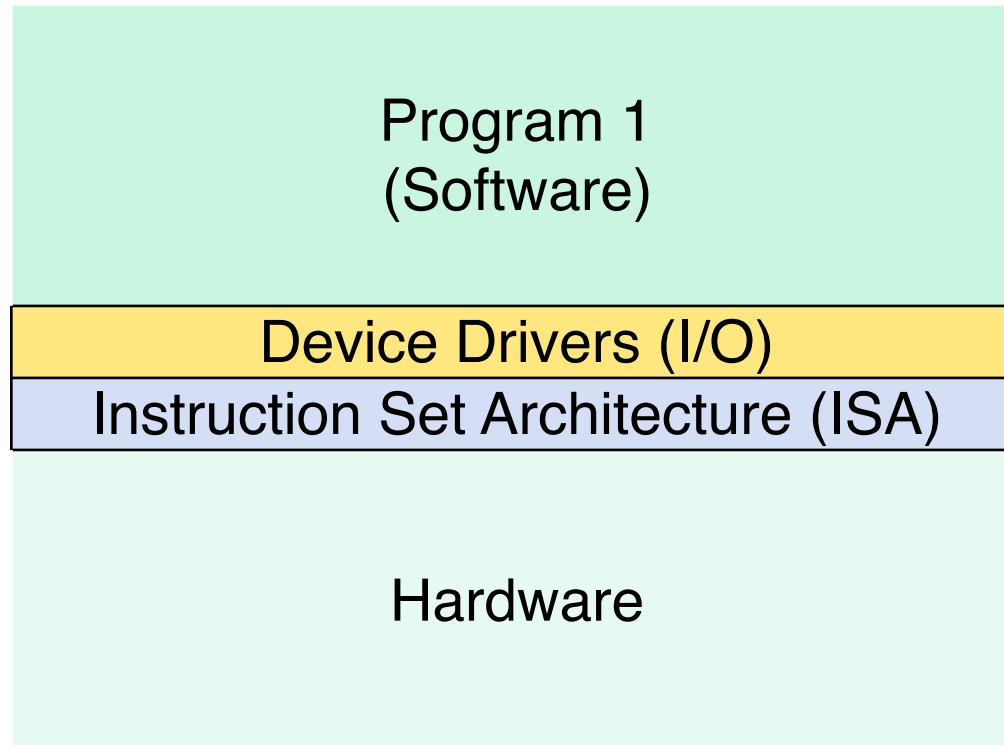
- A bunch of software and data residing somewhere in memory.
 - But its not just *any* software.
- OS is the most privileged software in a computer.
 - *Privileged* means that OS can do special things, like write to disk, talk over the network, control memory and CPU usage, etc.
- OS manages all system resources
 - CPU, Memory, and I/O devices

Why do we need an OS?



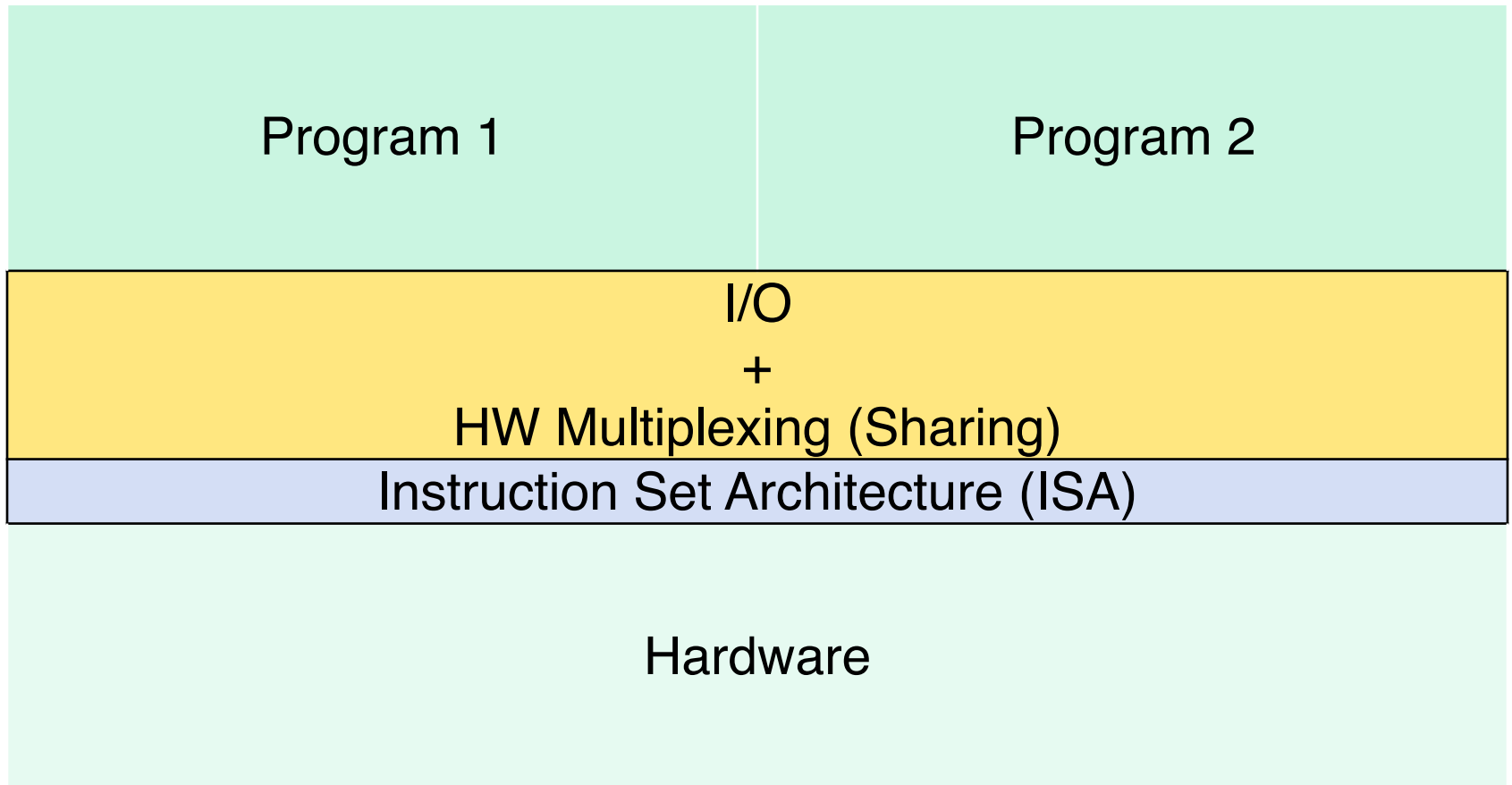
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But the program doesn't know how to access hardware devices for input/output (I/O)



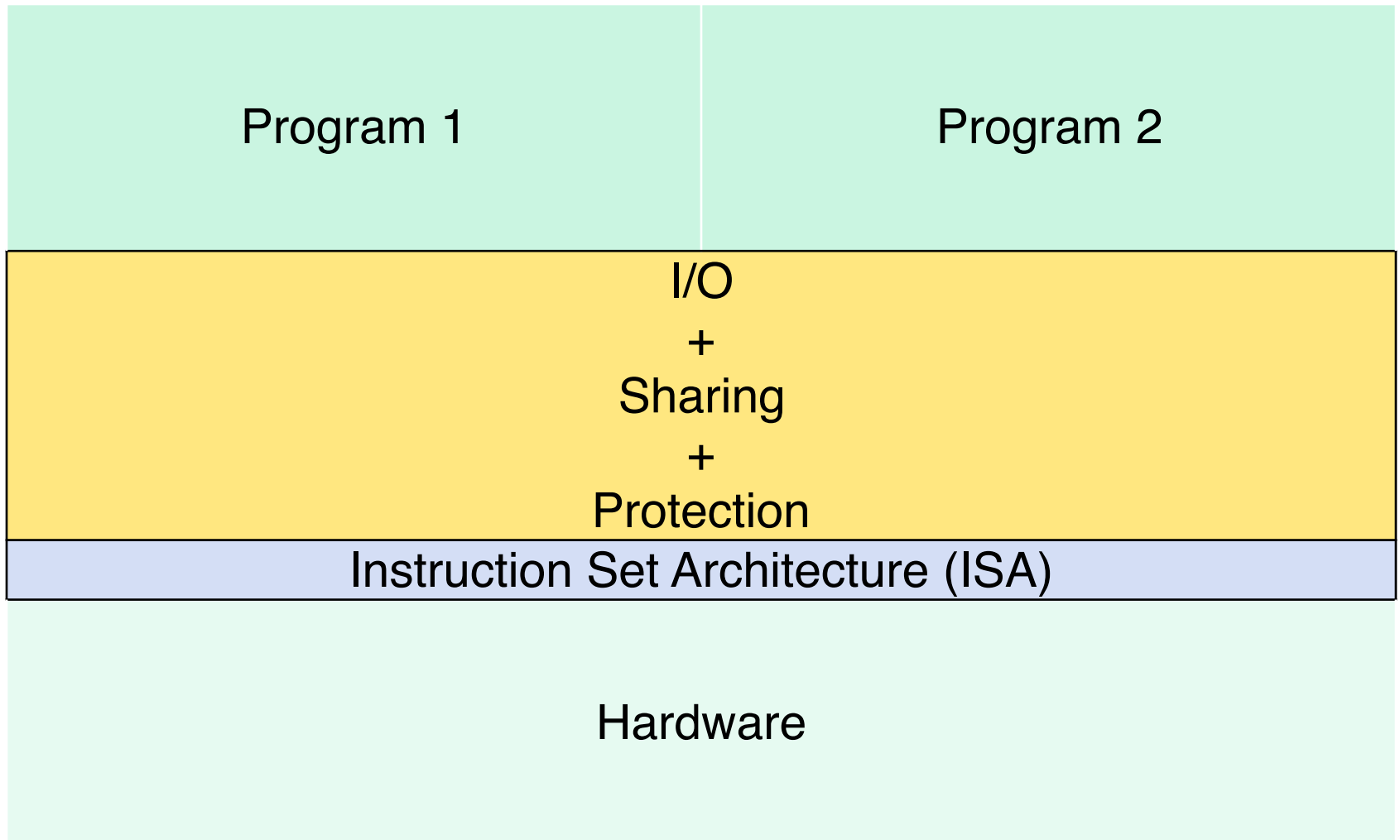
Why do we need an OS?

But what if two programs need to share the hardware?



Why do we need an OS?

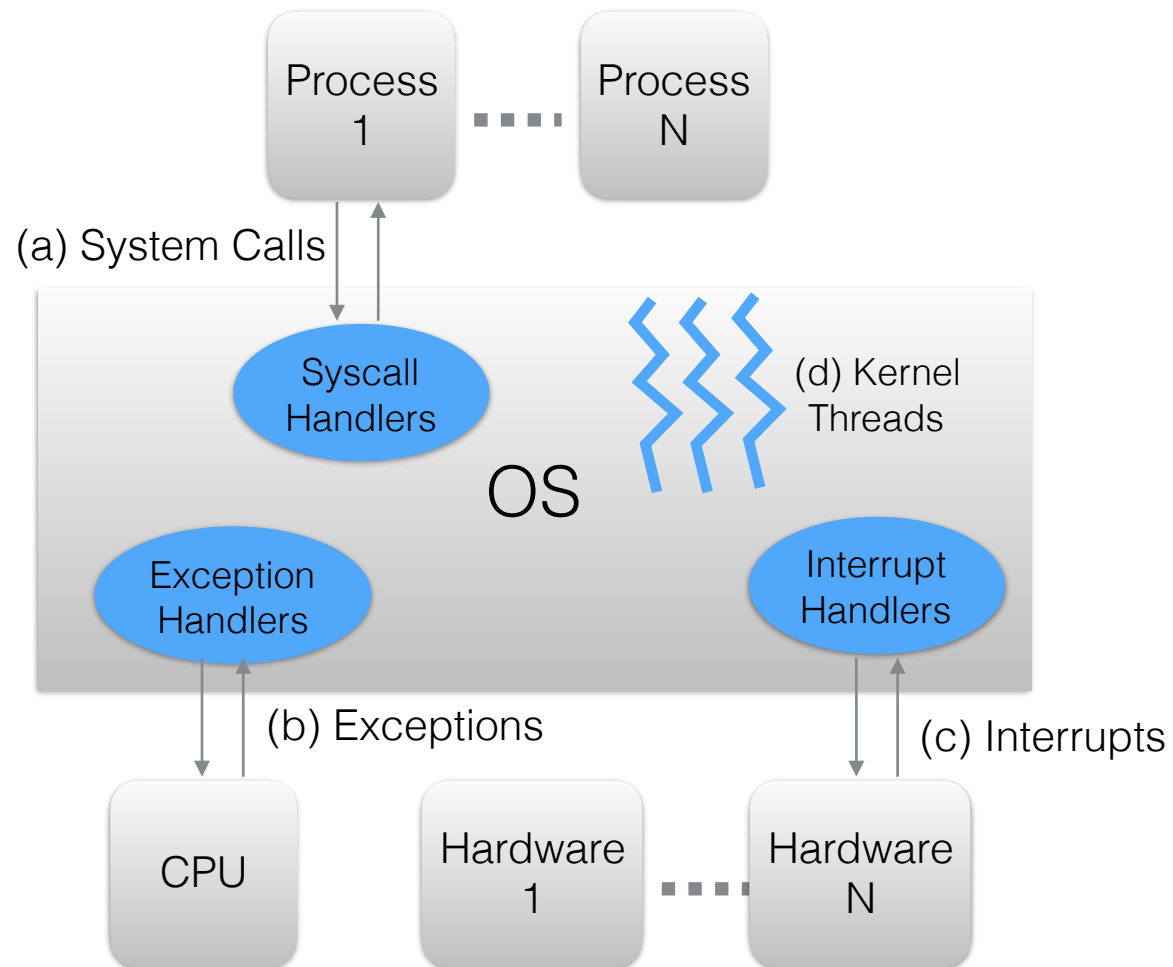
But what if the two programs don't trust each other?



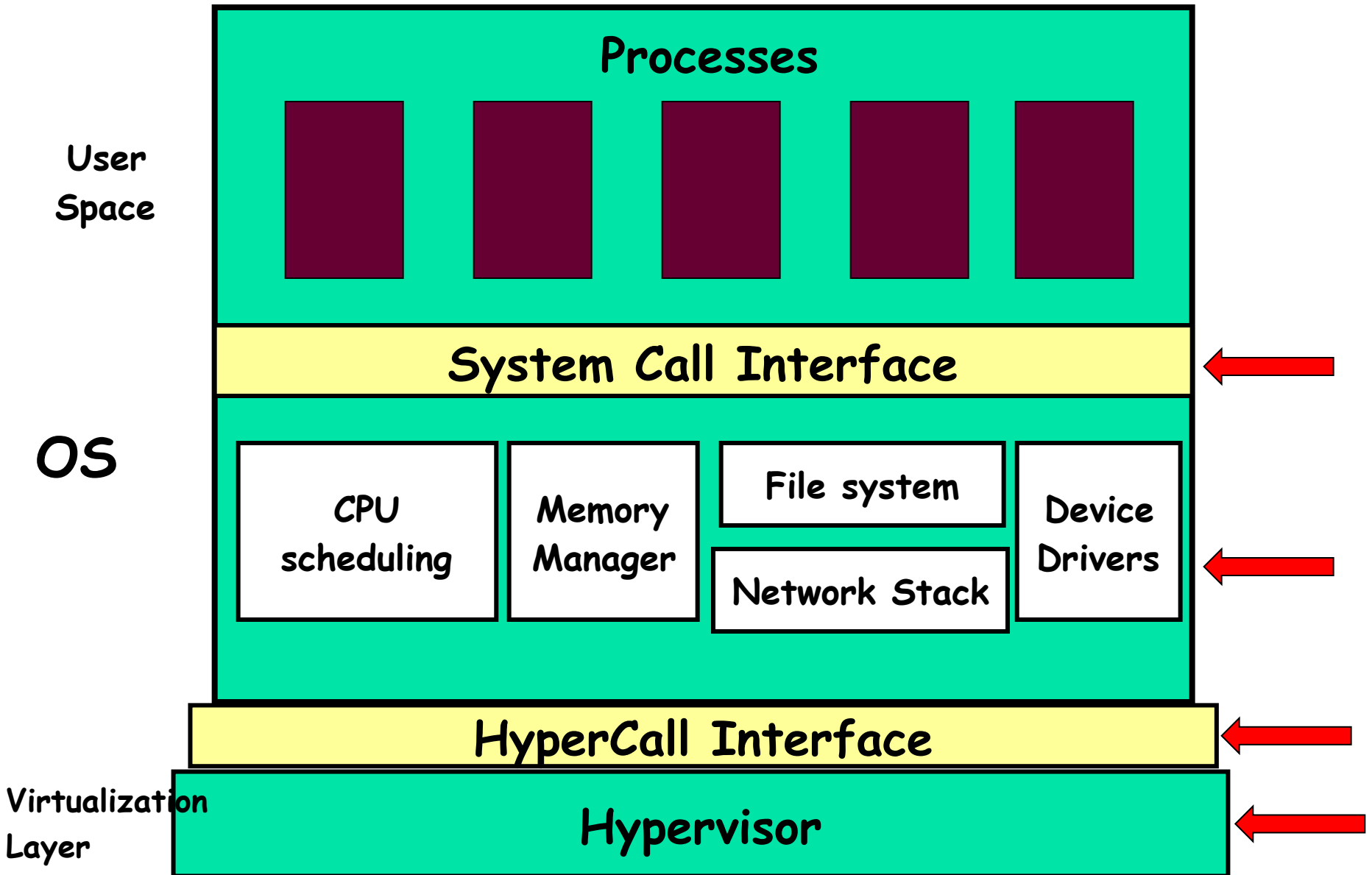
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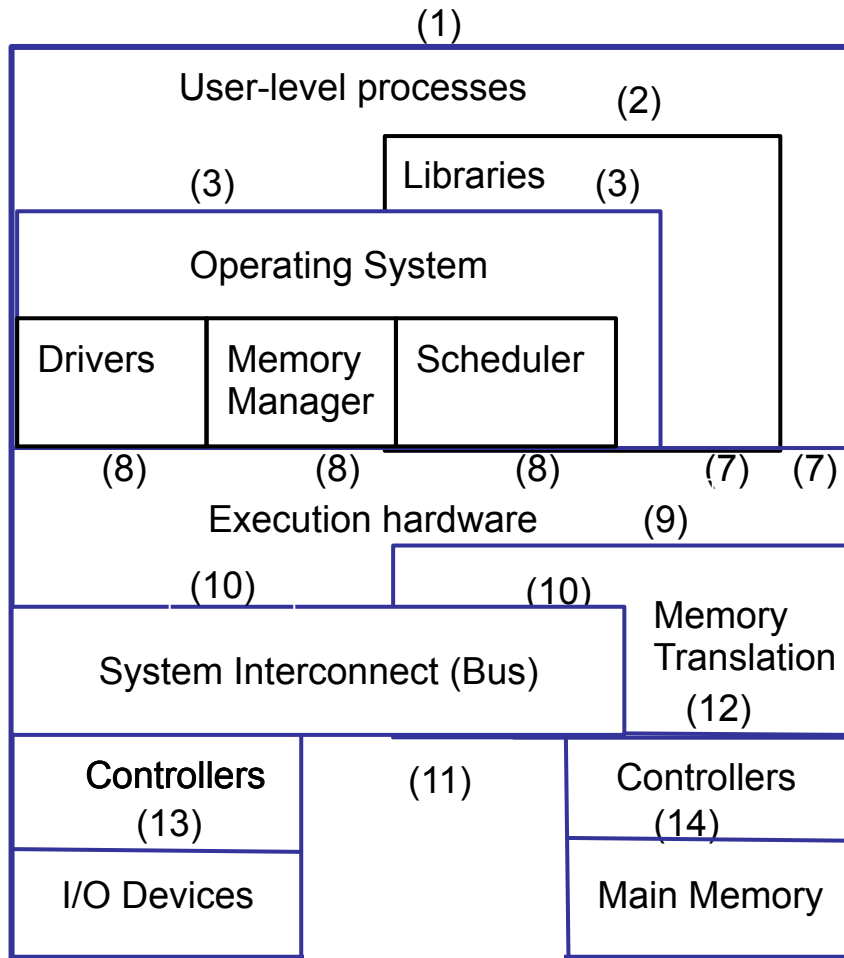
Four ways to invoke OS code



Layers of Software



Interfaces in a Computer System



User ISA : 7
System ISA : 8
Syscalls : 3
ABI : 3, 7
API : 2, 7

ISA = Instruction Set Architecture
ABI = Application Binary Interface
API = Application Programming Interface

History of OS

- 1950s and 1960s: Early operating systems were simple batch processing systems
 - Users provided their own “OS” as libraries.
- 1960s and 1970s: Multi-programming on mainframes
 - Concurrency, memory protection, Kernel mode, system calls, hardware privilege levels, trap handling
 - Earliest Multics hardware and OS on IBM mainframes
 - Which led to the first UNIX OS which pioneered file systems, shell, pipes, and the C language.
- 1980s: Personal computing era
 - MacOS, IBM PC and its DOS, Windows, and so forth.
 - Unfortunately, many lessons from earlier multi-programming era were forgotten and had to be re-learned (painfully).
- 1980s also saw the fragmentation of UNIX
 - Each big company had its own version (IBM, Apple, HP, SUN, SGI, NCR, AT&T....)
 - LOT of legal wrangling over IP and copyrights
- 1990s: Then came BSD and Linux
 - Open source.
 - Led the way to modern OSes and cloud platforms
- 1990s also saw wider adoption of threads and parallelism
- 2000 and beyond: Mobile device OS and hypervisors
 - Android, iOS
 - VMWare ESX, Xen, Linux/KVM etc.