Operating System

Yuqiao Meng

2021–9–124

Contents

1 Overview

1.1 What?

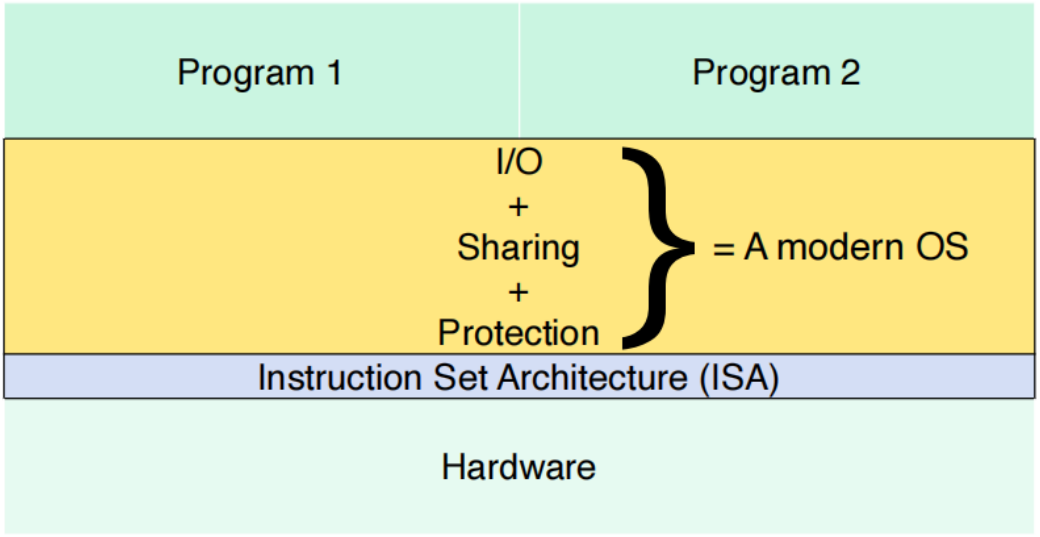
What is an Operating System? What's its reponsibility?

- A bunch of software and data residing somewhere in memory.
- The most privileged software in a computer. It can do special things, like write to disk, talk over the network, control memory and CPU usage, etc
- Manages all system resources, including CPU, Memory, and I/O devices.

1.2 Why?

Why do we need an OS?

- OS helps program to control hardwares.
- OS determines the way programs share resources.
- OS protects hardwares and programs from getting attacked.
- OS stores files persistently.



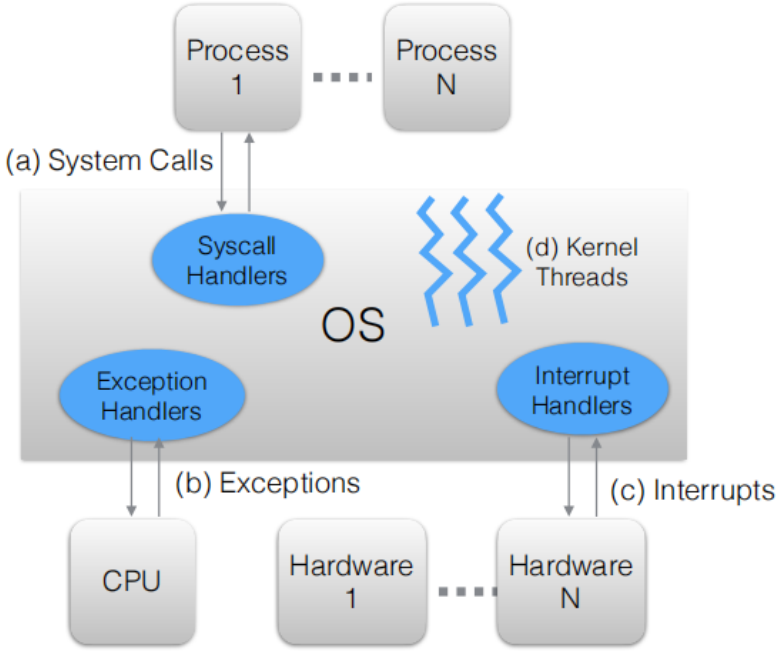
1.3 How

1.3.1 Virtulization

- Definition: OS takes a physical resource (such a sthe processor, or memory, or a disk) and transforms it into a more general, powerful, and easy-to-use virtual form of itself.
- Resource Virtulization
  - Many(virtual)-to-one(physical): CPU Virtulization
  - One-to-many: Disk Virtulization
  - Many-to-many

1.3.2 How to invoke OS code?

- System calls: Function calls into the OS, that OS provides these calls to run programs, access memory and devices, and other related actions.
- Exceptions: CPU will raise an exception to the OS when the running program do something wrong
- Interrupts: Hardwares send interrupts to invoke OS
- Kernel Threads: Programs run in the kernel context, executing kernel level functions.

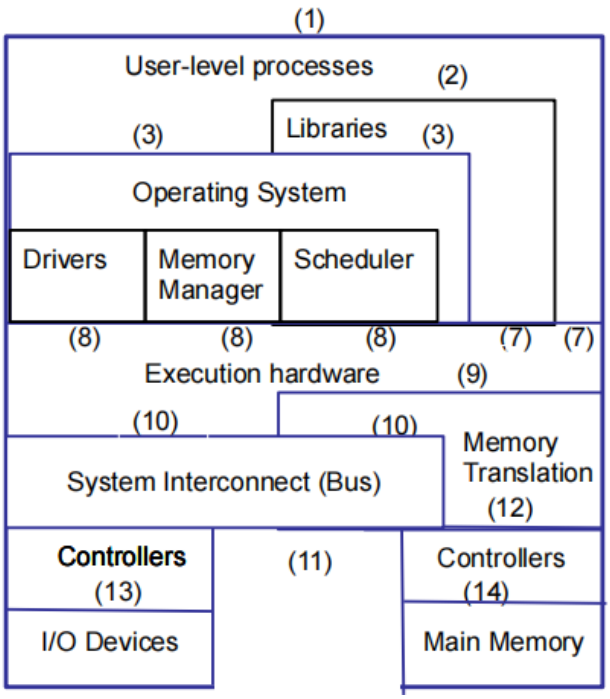


1.4 Interface

1.4.1 Explaination

- Instruction Set Architecture(ISA): the language CPU understand
- User ISA: ISA that any program can execute, it's accessible for all programs, doesn't need the service of operating system
- System ISA: ISA that only operating system is allowed to execute.
- Application Binary Interface(ABI): the combination of syscalls and User ISA(3, 7), it's the view of the world, seen by programs.
- Application Programmers' Interface(API): the combination of libraries and User ISA(2, 7), it's the tools programmer use to write codes.

1.4.2 Interfaces in a Computer System



- User ISA: 7
- System ISA: 8
- Syscalls: 3
- Application Binary Interface: 3, 7
- Application Programmers' Interface: 2, 7

1.5 History

- First Computer: Atanasoff–Berry computer, or ABC.
- First OS: GM-NAA I/O, produced in 1956 by General Motors' Research division for its IBM 704.
- First language: Plankalkül, developed by Konrad Zuse for the Z3 between 1943 and 1945.

- First programmer: Ada Lovelace