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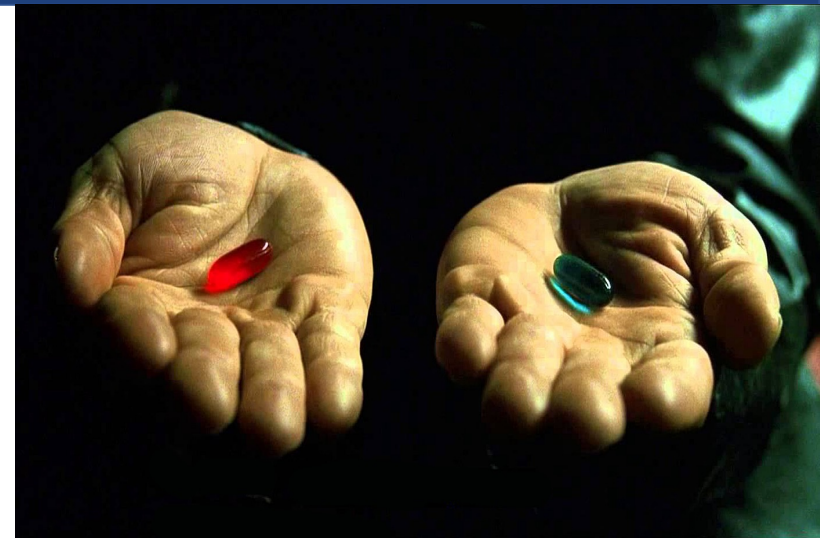
CMPSC 311 - Introduction to Systems Programming

Virtual Machine

Professors:

Suman Saha

(Slides are mostly by *Professor Patrick McDaniel* and
Professor Abutalib Aghayev)

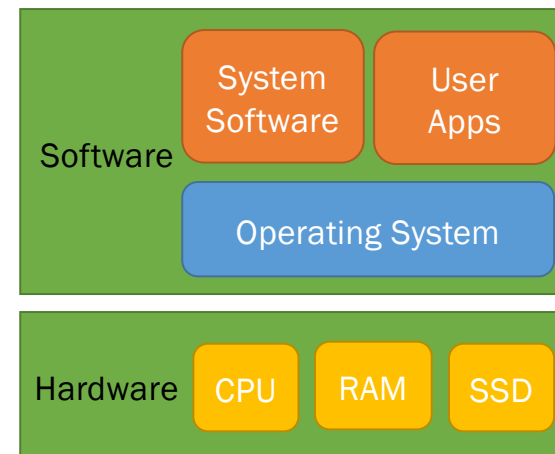


Operating Systems... 10,000-foot view



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- What is an operating system (OS)?
 - **Software** that manages machine **hardware** and provides *interface* and *abstractions* atop which user applications and systems software is built
- Types of machines/hardware
 - Desktops, laptops, servers, mobile devices
- Examples of OSs
 - Windows, macOS, Linux, FreeBSD, Android, iOS
- OS dominance by sector
 - Desktop/laptops: Windows > macOS > Linux
 - Server: no reliable source, probably Linux
 - Mobile: Android > iOS

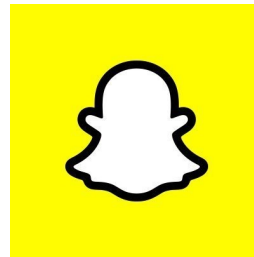


Why learn systems programming on Linux?



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- It is free. It is ubiquitous. You want to run your tech company on Linux...



Alibaba Group

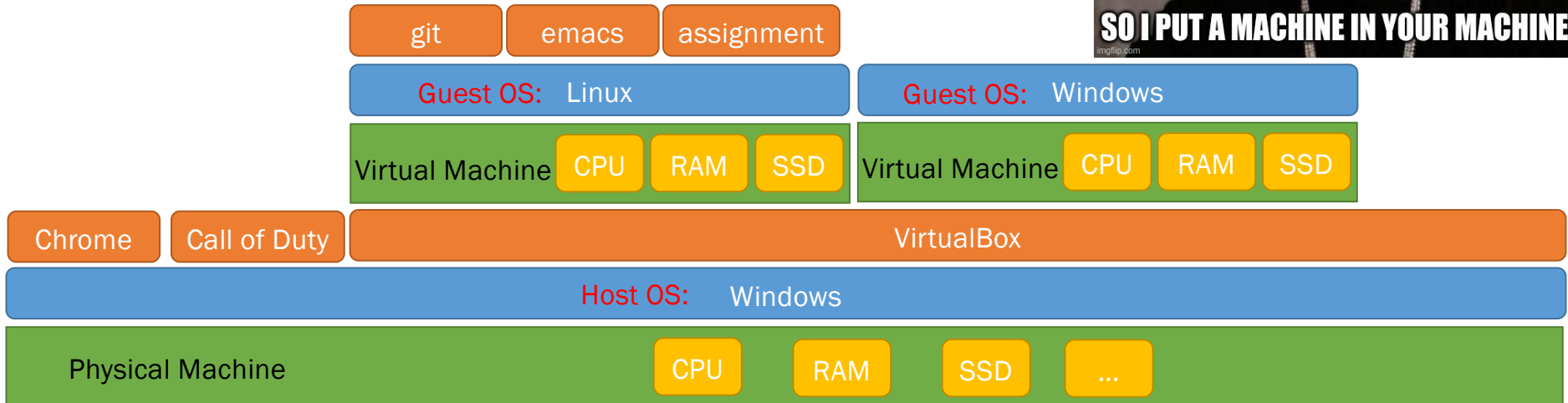
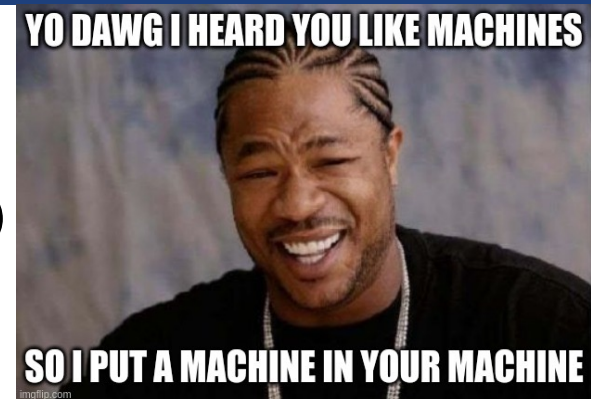


How to run Linux on your machines?



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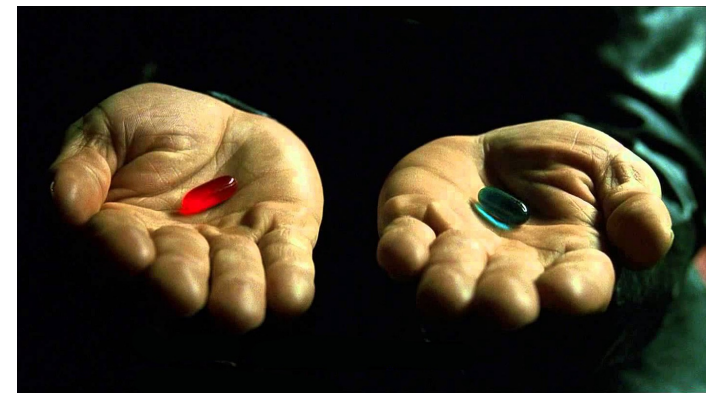
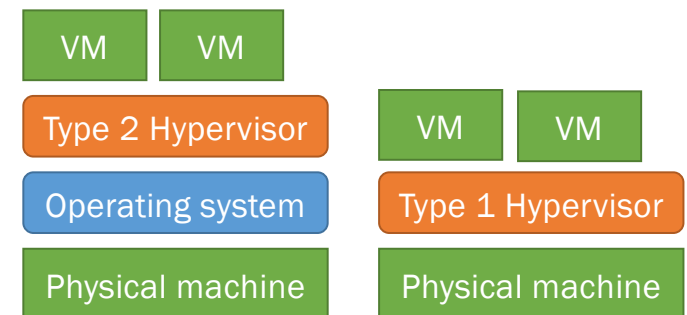
- Most of you probably run Windows or macOS
- That's where VirtualBox comes into play
- VirtualBox is a **hypervisor (or virtual machine monitor)**
 - A software that creates virtual machine (VM)



More on hypervisors



- There are two types of hypervisors
 - **Type 1:** runs on bare physical machine
 - **Type 2:** runs on an operating system
- Examples of type 2 hypervisors
 - VMware Workstation (Fusion)
 - QEMU
 - VirtualBox
 - Parallels Desktop for Mac
 - UTM
- Examples of type 1 hypervisors
 - VMware ESXi
 - Xen



Benefits of Virtualization



Without Virtualization

- Company manage their own servers
- Install applications
- OS is tightly coupled to the hardware
- One point of failure

With Virtualization

- Provide Virtual Machine Image
- OS as a portable file
- Includes OS and all application on it
- You can have backups of your entire OS which is called snapshot

Virtual Machine Image (VMI)



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- Secure very easily
- Portable
- Not dependent on physical server

We Will Use



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- Virtualbox
 - Download Virtualbox 6.1.30 from: <https://www.virtualbox.org/>
- Guest OS
 - Ubuntu 20.04.3: <https://ubuntu.com/download/desktop>
 - Installation video demo: <https://youtu.be/x5MhydijWmc>
- For students using Mac with a M1 chip (MacBoook air/pro/mini from 2020 onwards or iMac from 2021 onwards)
 - Download UTM from <https://mac.getutm.app/>
 - Download Ubuntu 20.04.02 for arm <https://ubuntu.com/download/server/arm>
 - Detailed instructions: <https://mac.getutm.app/gallery/ubuntu-20-04>
 - Installation video demo: <https://youtu.be/hnwK-nkXolc>