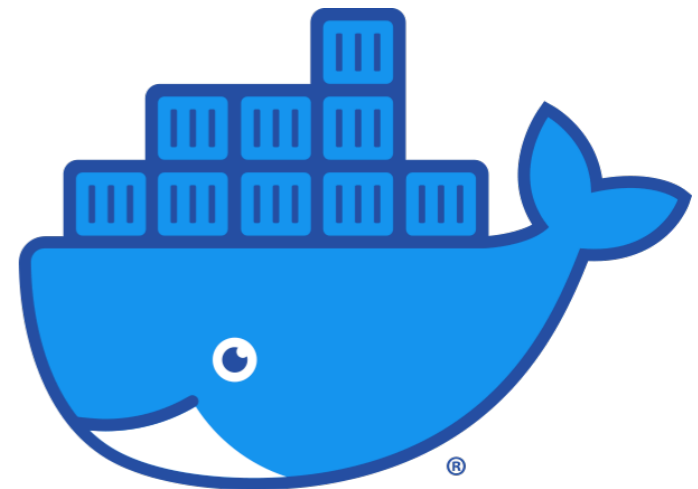


# [544] Docker Deployment

Tyler Caraza-Harter



# Learning Objectives

- use existing Docker images to launch containers
- define new Docker images using Dockerfiles
- troubleshoot common issues with running Docker containers

# Outline

## Virtualization

Images, Containers, and Dockerfiles

Demos...

# What is virtualization?

Definition: the illusion of **private** resources, provided by software

Contexts this semester

- Virtual Machines (hardware)
- Virtual Machines (languages)
- Virtual Operating System (container) *new today*
- Virtual Memory (covered later lecture...)

# What is virtualization?

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virtualized resources include CPU, RAM, disks, network devices, etc

VMs rarely use all their allocated resources, so overbooking is possible

**VM:** 8 GB of RAM  
and 4 cores

**VM:** 6 GB of RAM  
and 3 cores

**VM:** 8 GB of RAM  
and 6 cores

virtual machines  
for rent (by you)

**Physical Machine:** 16 GB of RAM and 8 CPU cores

actual hardware bought by cloud provider (like Google GCP) for their cloud services

# What is virtualization?

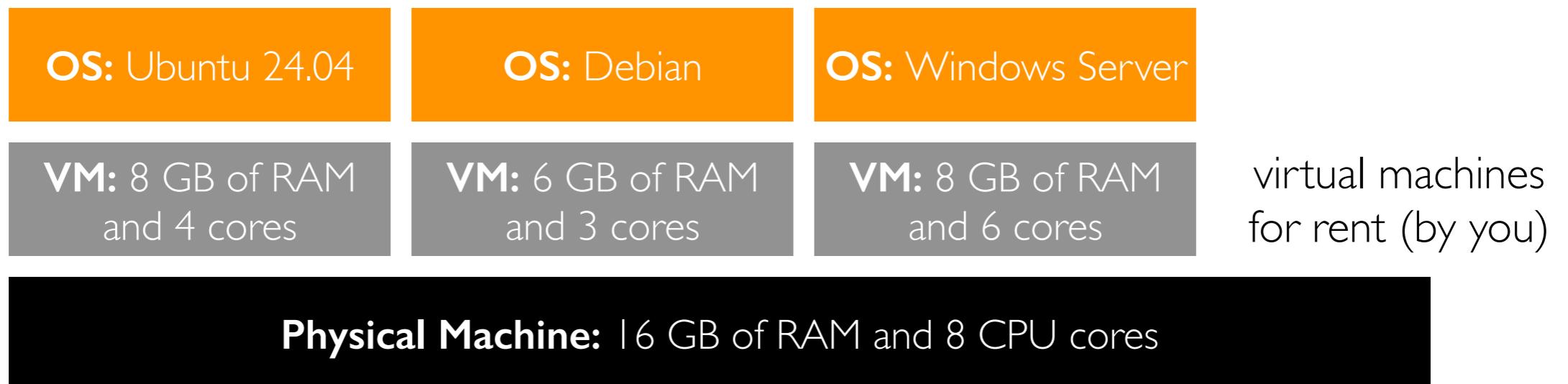
Definition: the illusion of **private** resources, provided by software

Contexts this semester

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**problem:** if each program is deployed to a different VM, operating system overheads will dominate

these operating systems are mostly unaware that their on VMs instead of physical hardware



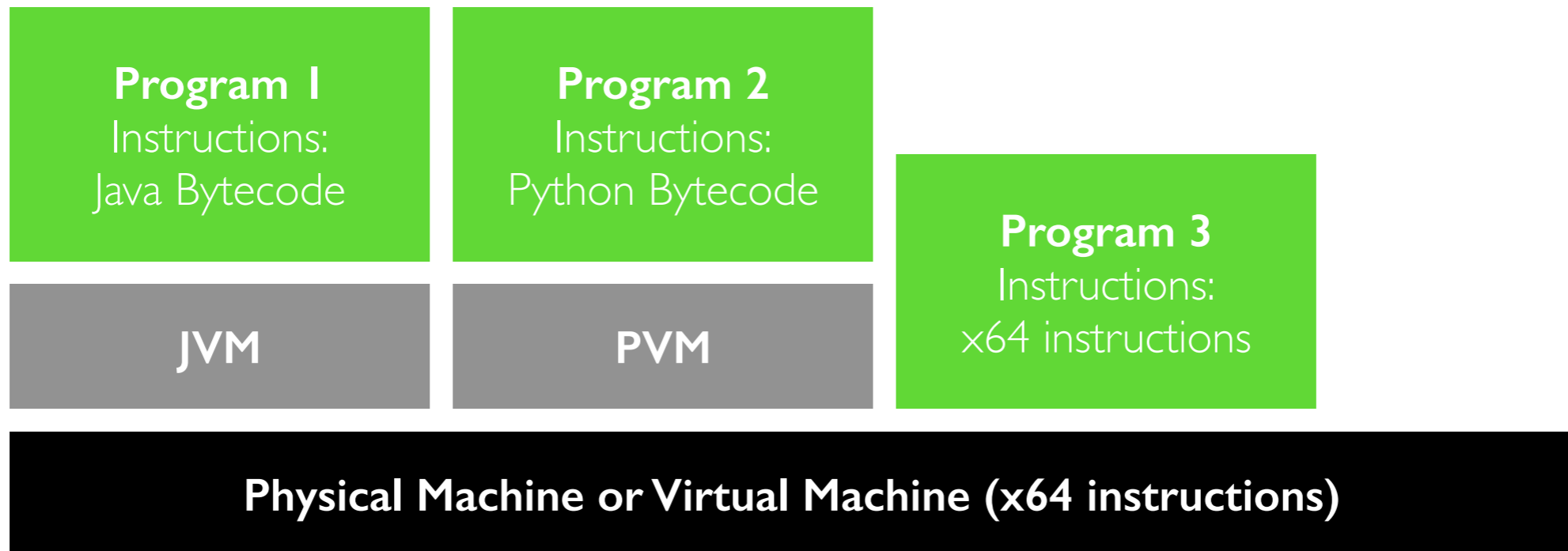
actual hardware bought by cloud provider (like Google GCP) for their cloud services

# What is virtualization?

Definition: the illusion of **private** resources, provided by software

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# What is virtualization?

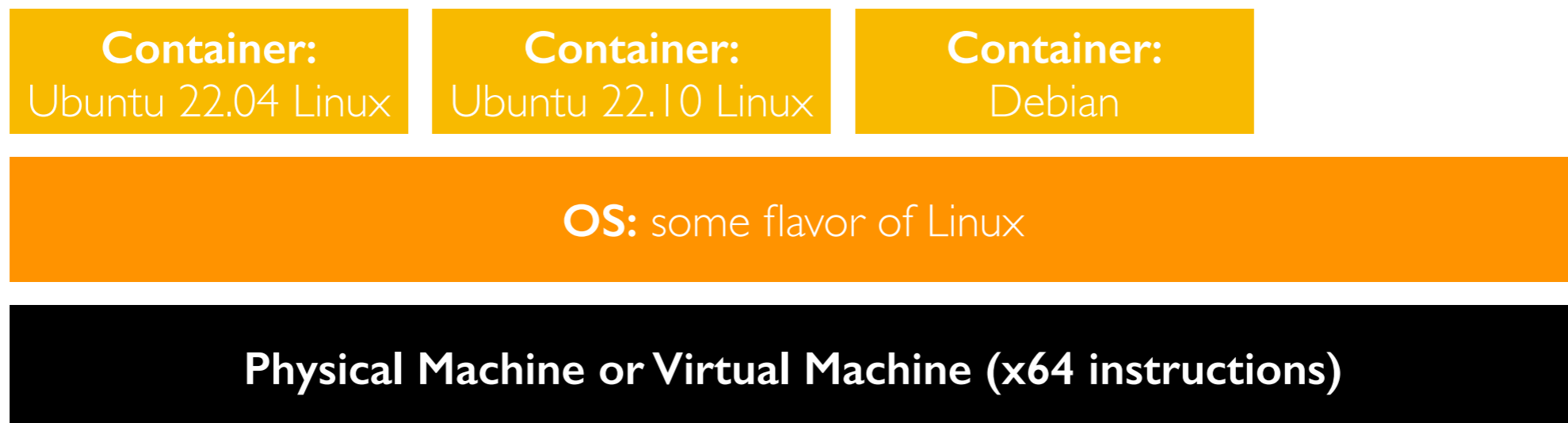
Definition: the illusion of **private** resources, provided by software

Contexts this semester

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Linux containers

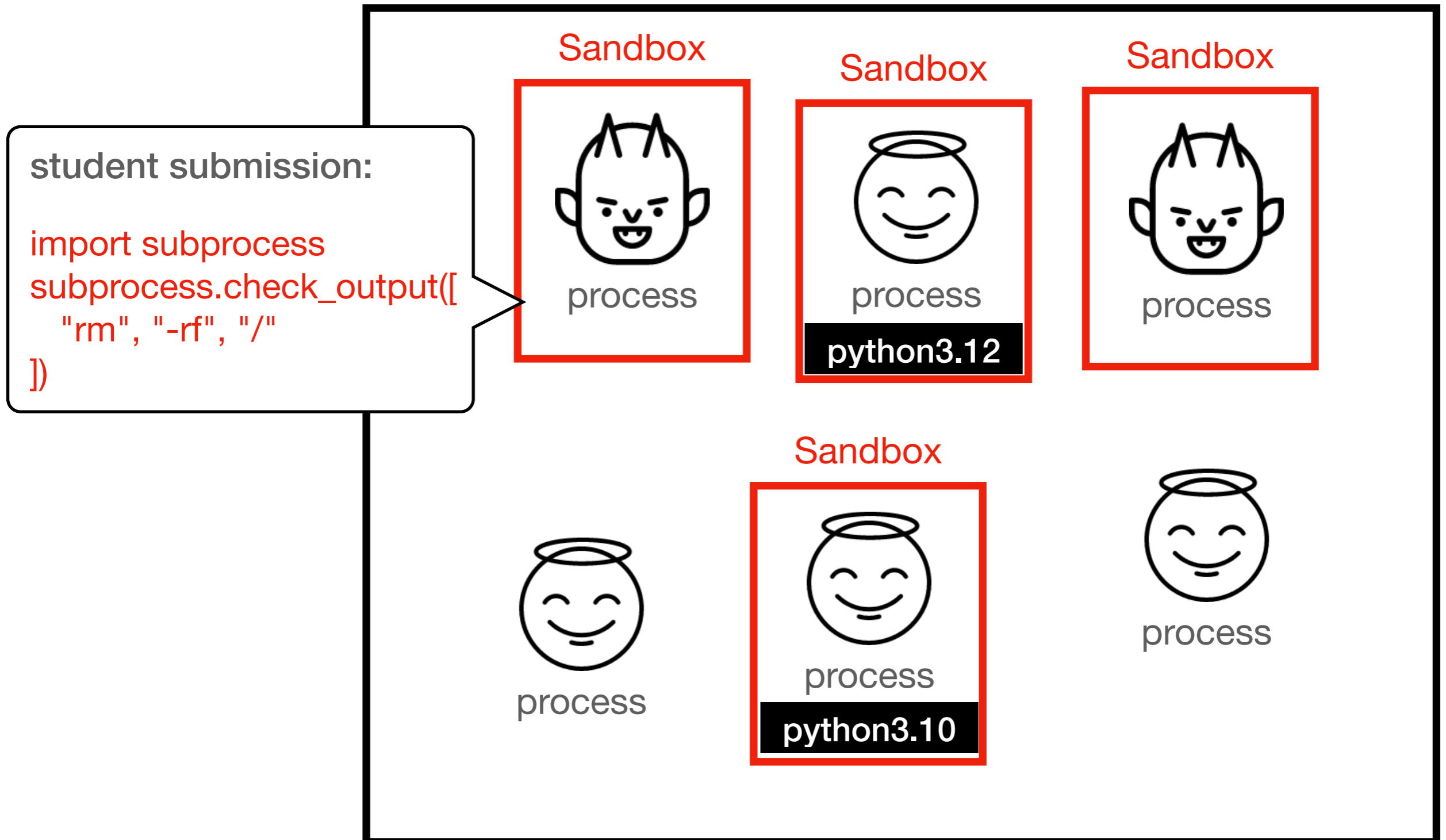
- Docker makes creation easy
- The "physical" OS is shared, which is very efficient
- Programs in different containers can use different flavors of Linux
- Cannot have a Windows container on Linux





# Containers and Virtual Machines are "Sandboxes"

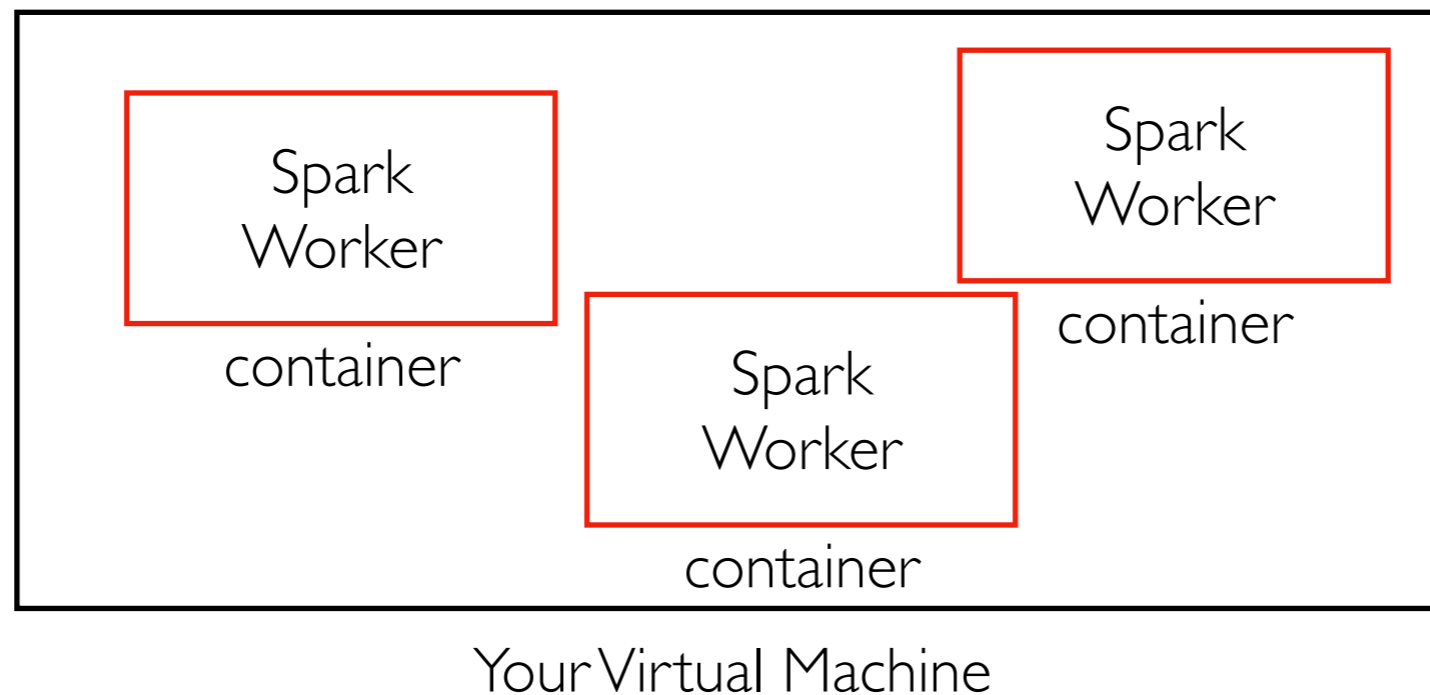
A Computer



# Docker containers

Containers are a lightweight alternative to virtual machines.

You'll run Docker containers this semester to have your own "mini cluster"



Resources of the "cluster" are limited to those of a single VM, so we'll scale projects accordingly. But the techniques will apply to large clusters and datasets.

# Outline

Virtualization

Images, Containers, and Dockerfiles

Demos

TIP: make notes of docker commands

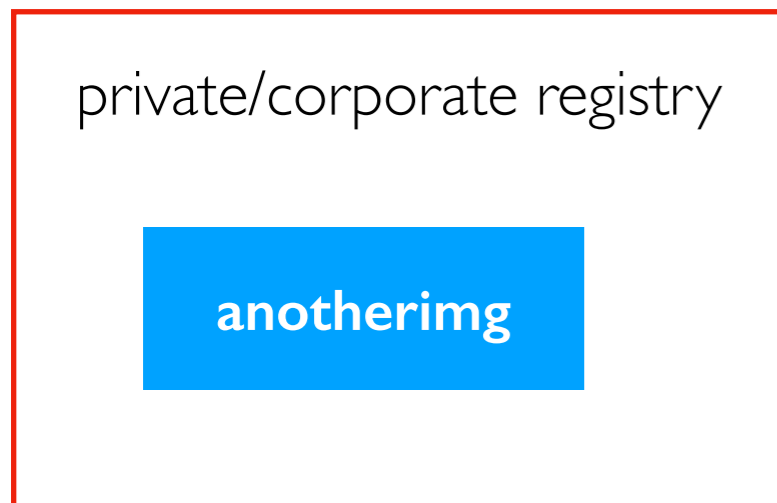
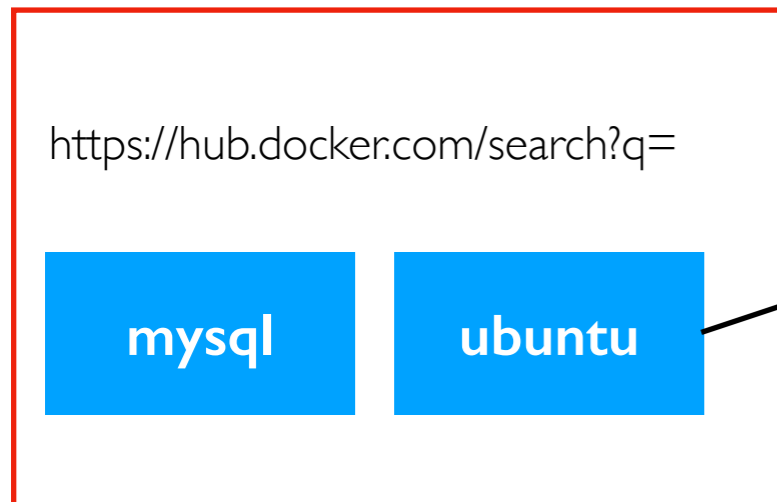
docker **SOME-COMMAND** arg1, arg2, ...

# Docker Install

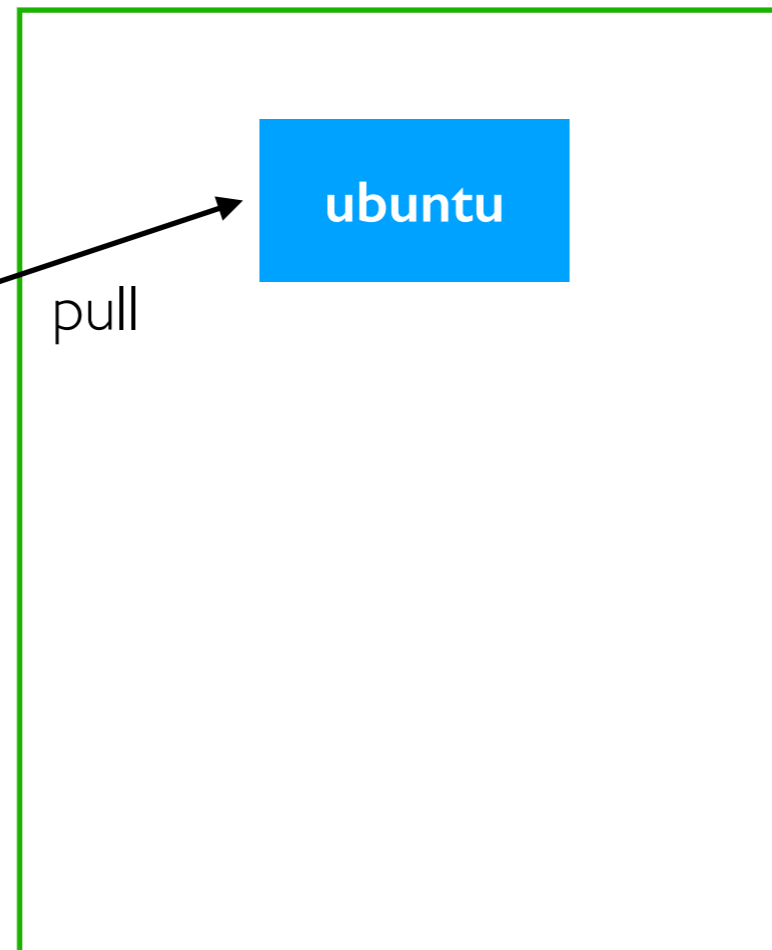
See notes: <https://git.doit.wisc.edu/cdis/cs/courses/cs544/f24/main/-/tree/main/pl#part-2-docker-install>

# Registries, Images, Containers, and Dockerfiles

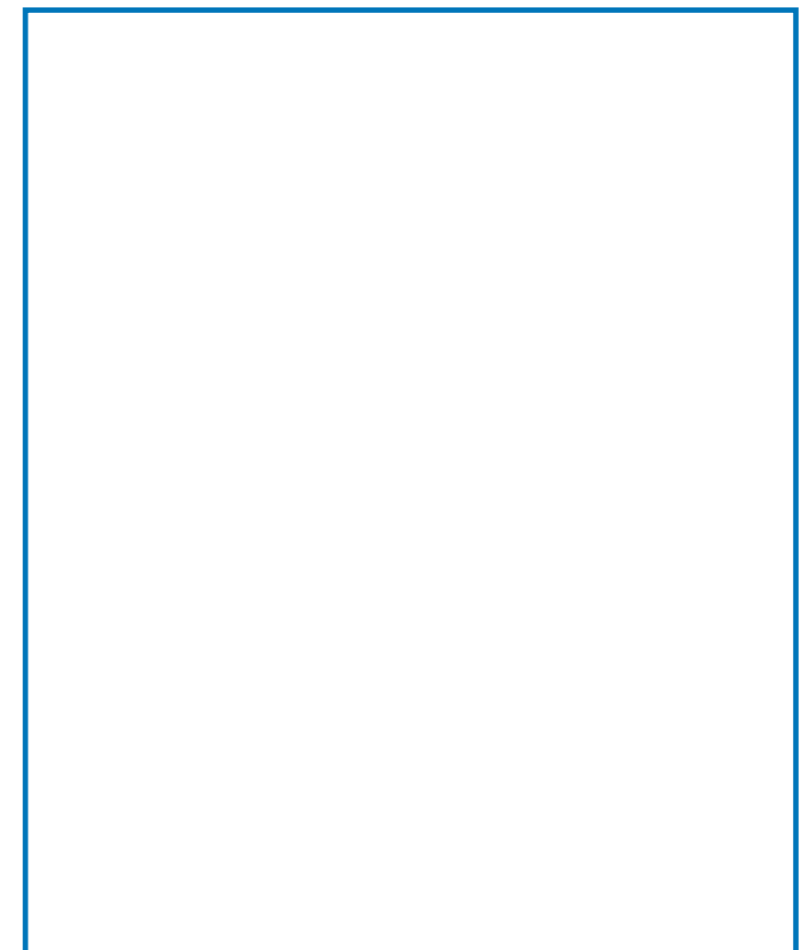
registries:



Images (on your VM)



Containers (on your VM)

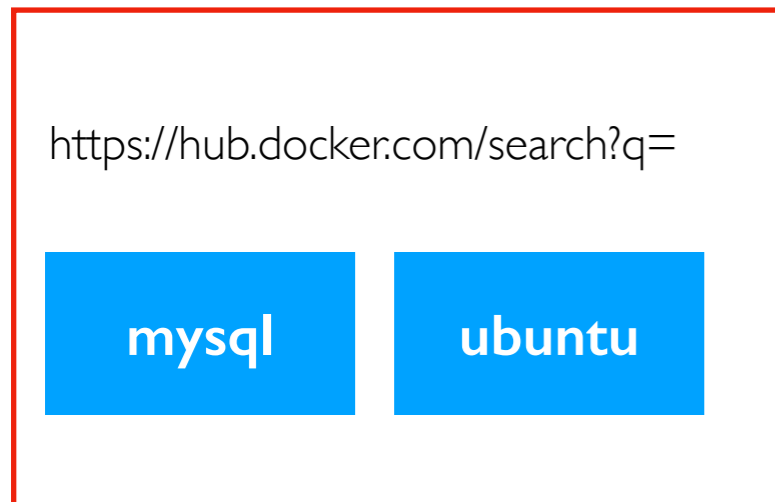


Images

- snapshot of installed software from which to create a container
- `docker pull ubuntu:22.04`

# Registries, Images, Containers, and Dockerfiles

registries:

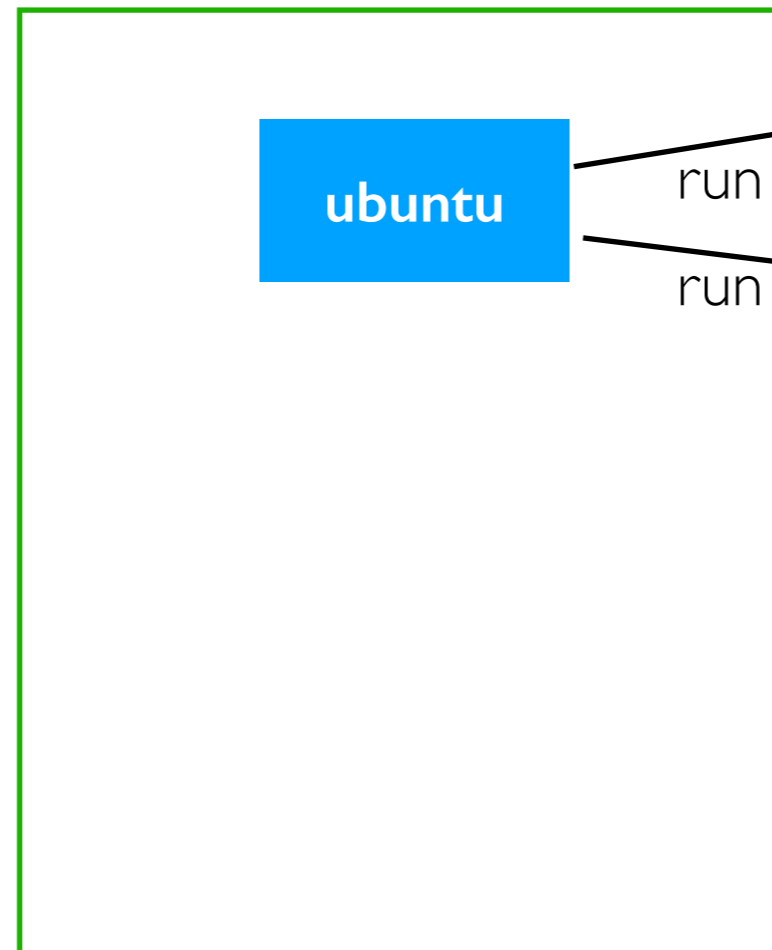


private/corporate registry

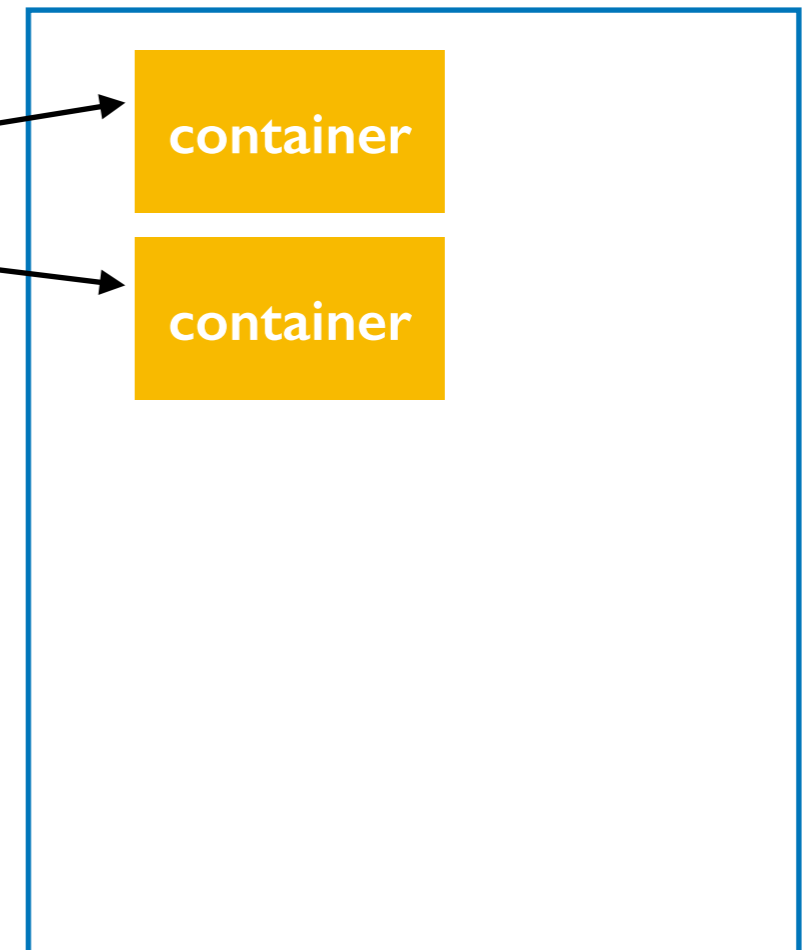
anotherimg

A red-bordered box containing the text 'private/corporate registry' and a blue box labeled 'anotherimg'.

Images (on your VM)



Containers (on your VM)

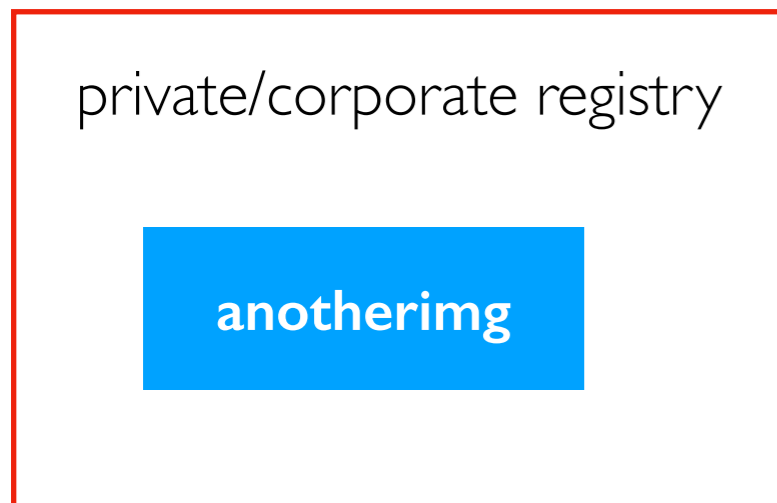
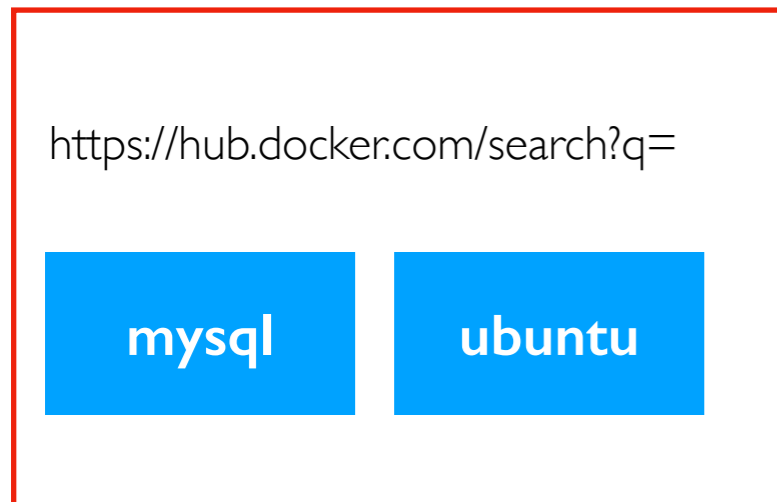


Containers

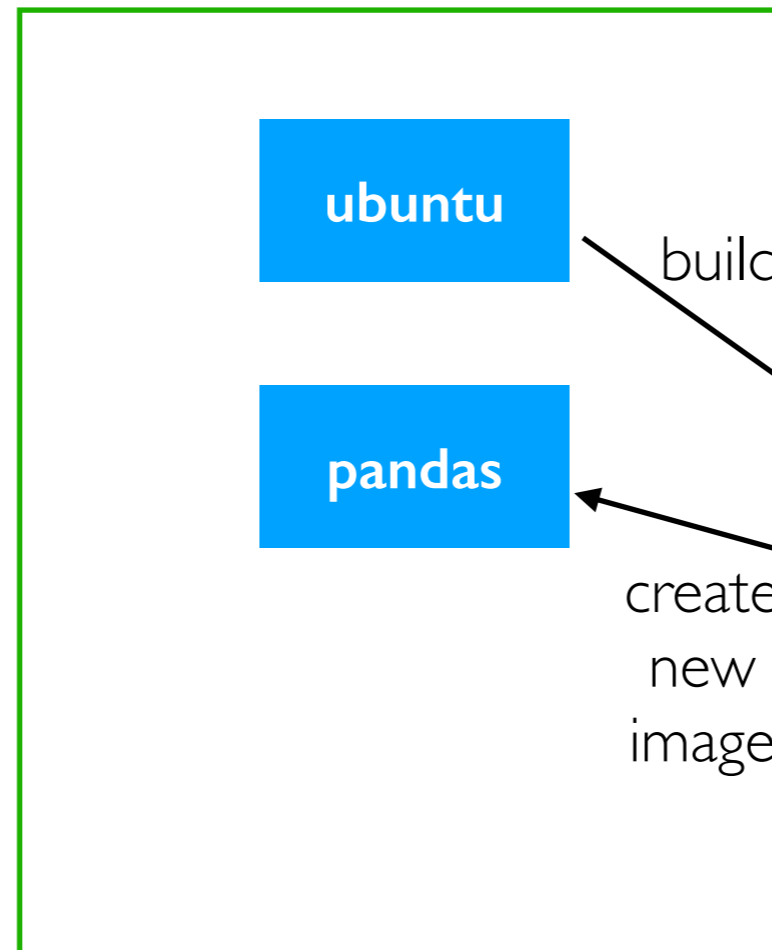
- Linux sandbox in which to run processes
- docker **run** ubuntu

# Registries, Images, Containers, and Dockerfiles

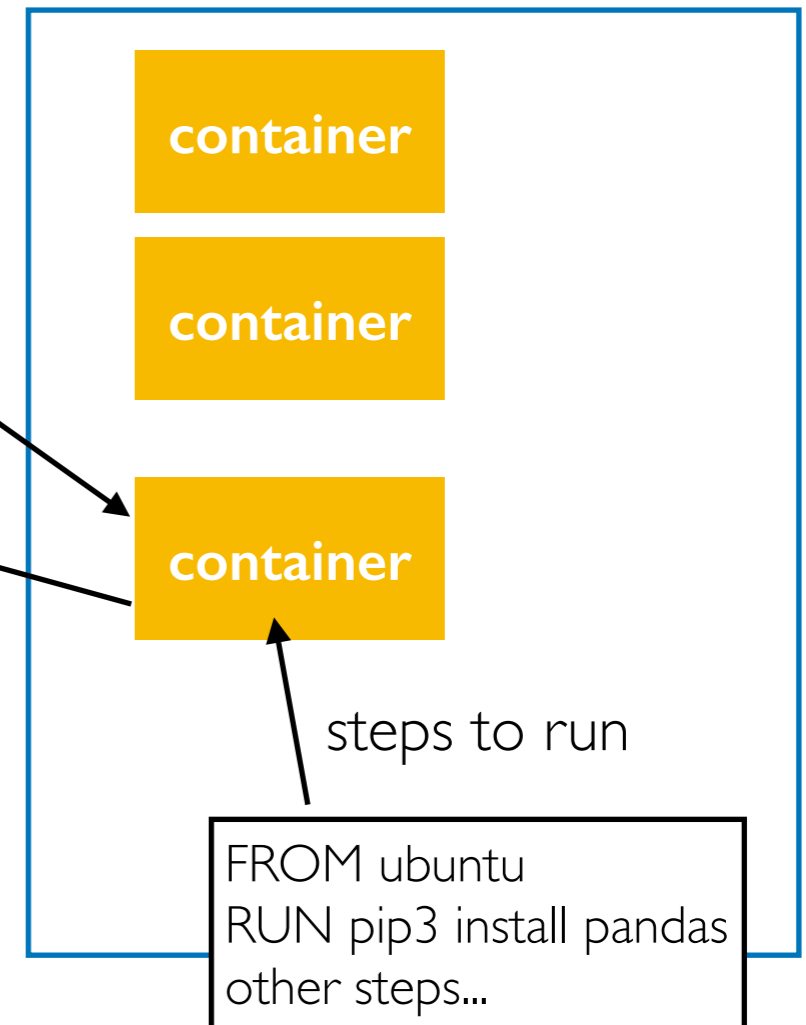
registries:



Images (on your VM)



Containers (on your VM)



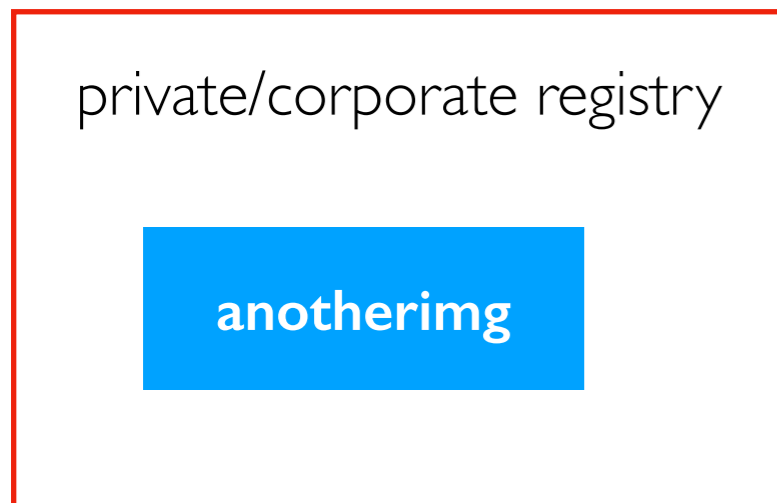
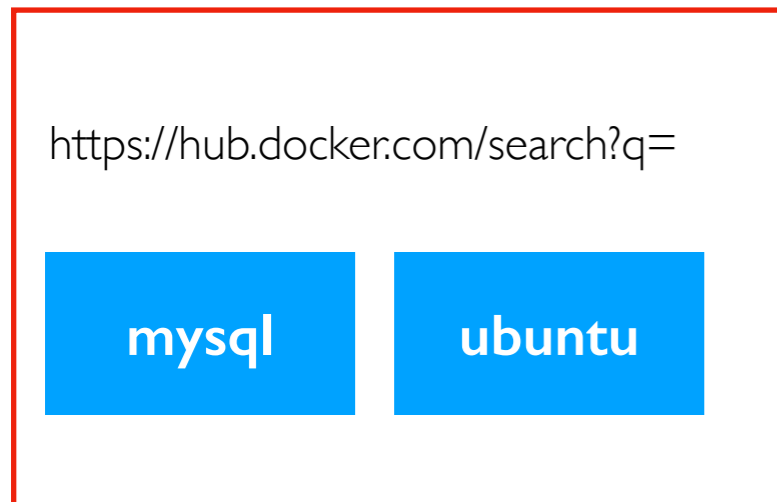
Dockerfiles

- steps to run in a container (like installs)
- creates a new image
- docker **build** myimg -t pandas

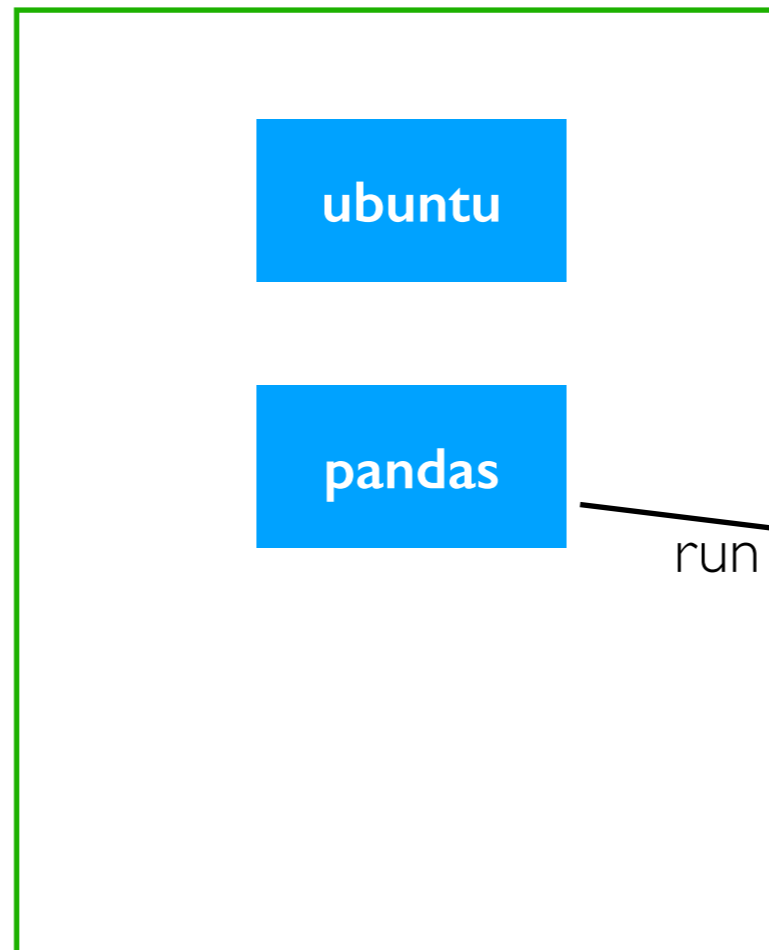
Dockerfile

# Registries, Images, Containers, and Dockerfiles

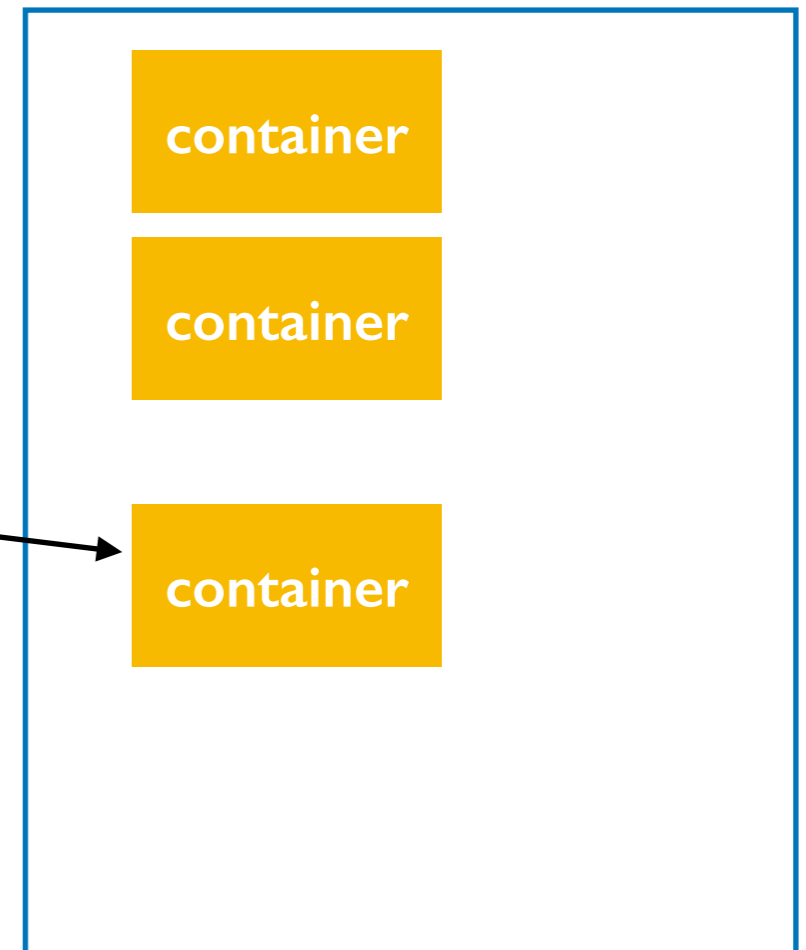
registries:



Images (on your VM)



Containers (on your VM)



Reproducibility

- Docker files unambiguously describe the setup
- Others can get all the same version numbers



Demos...