[544] Docker Deployment

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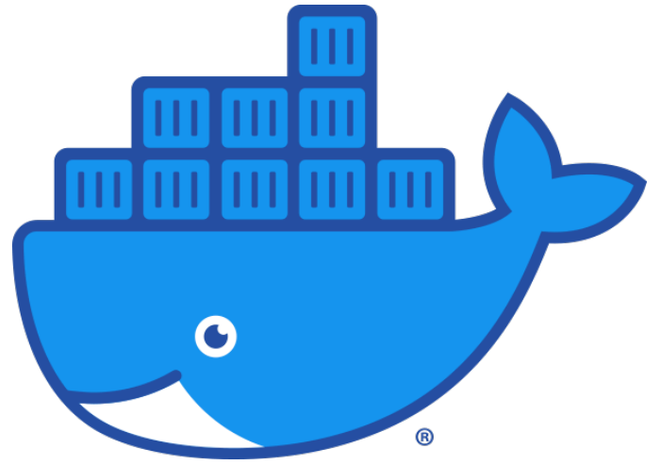

Learning Objectives

- 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...)

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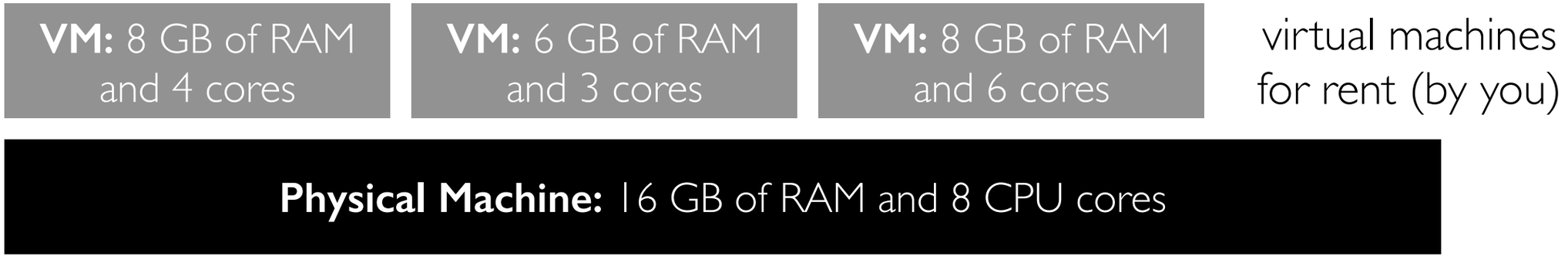
virtualized resources include CPU, RAM, disks, network devices, etc

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



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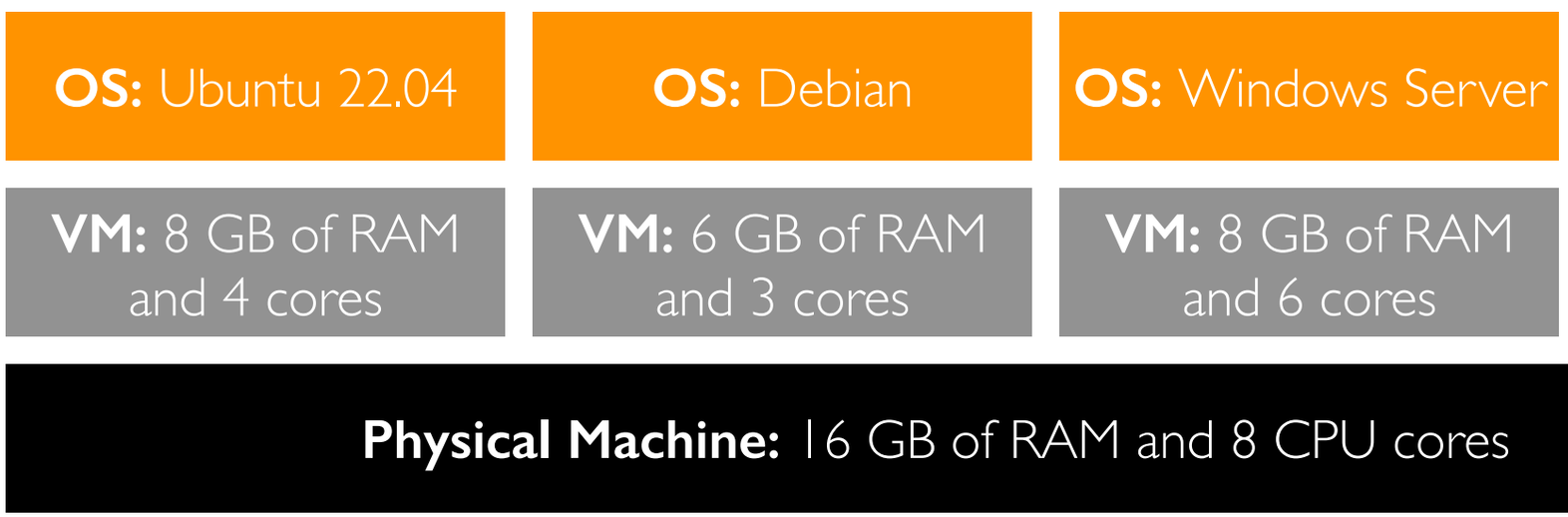
problem: if each program is deployed to a different VM, operating system overheads will dominate

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



virtual machines for rent (by you)

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

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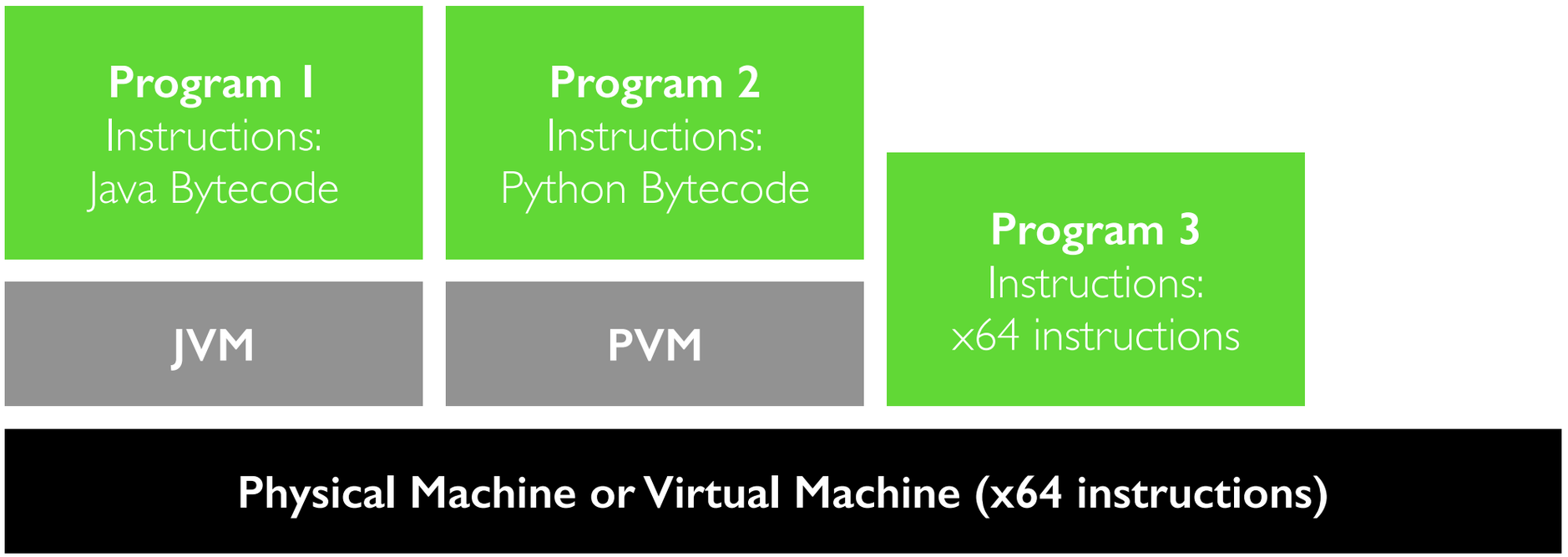

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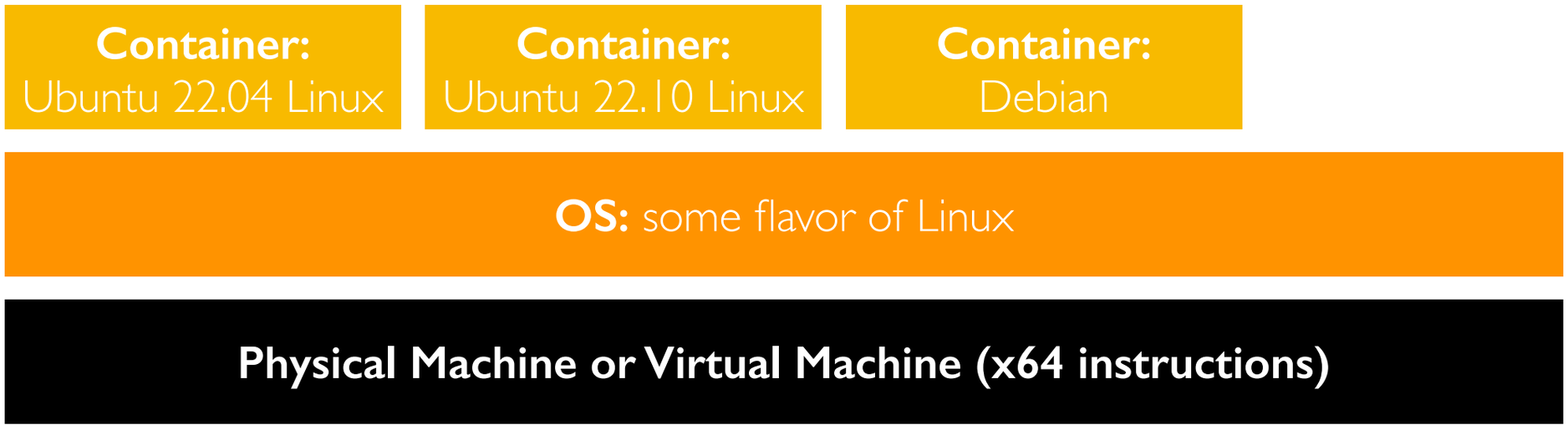
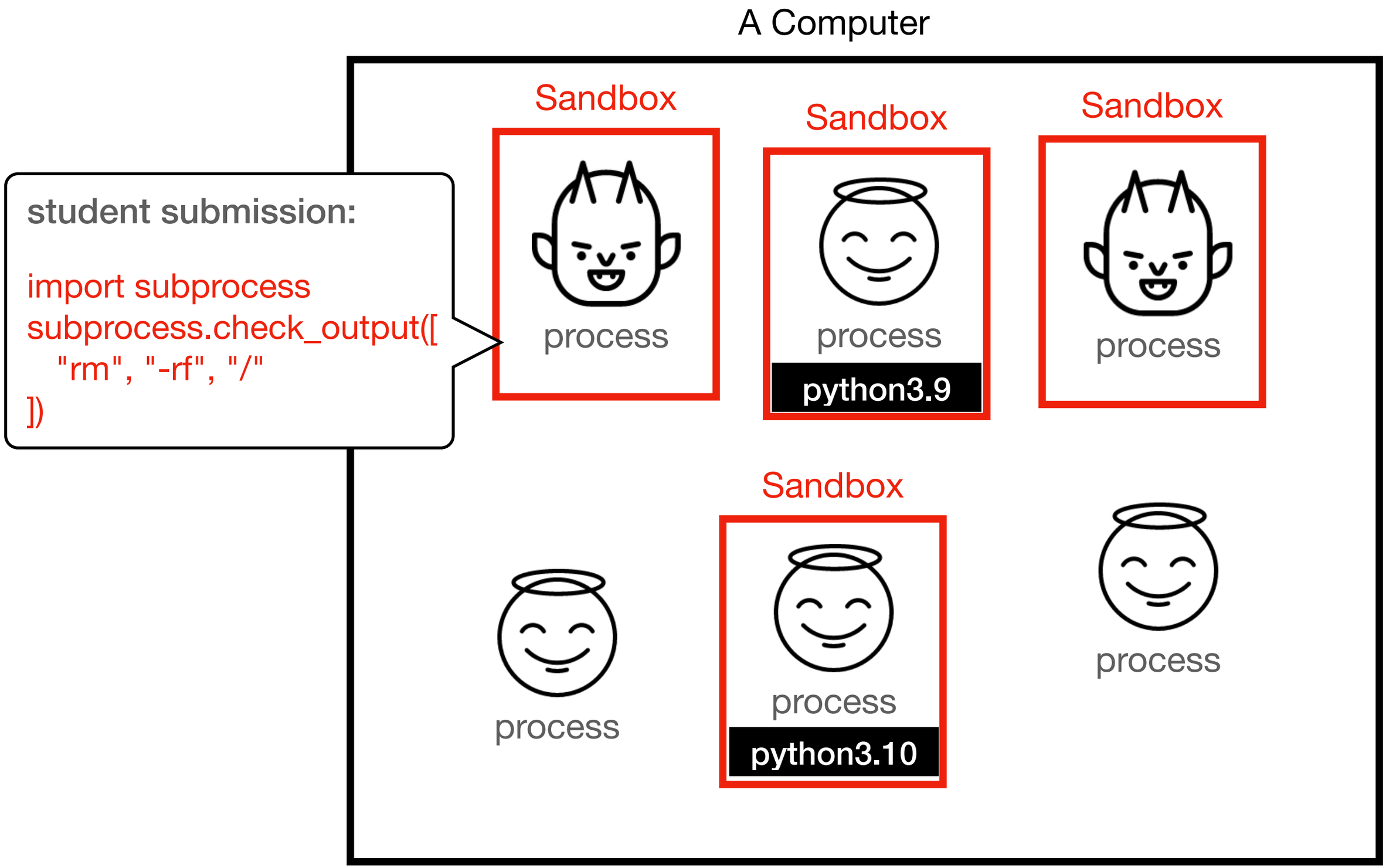
Linux containers

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



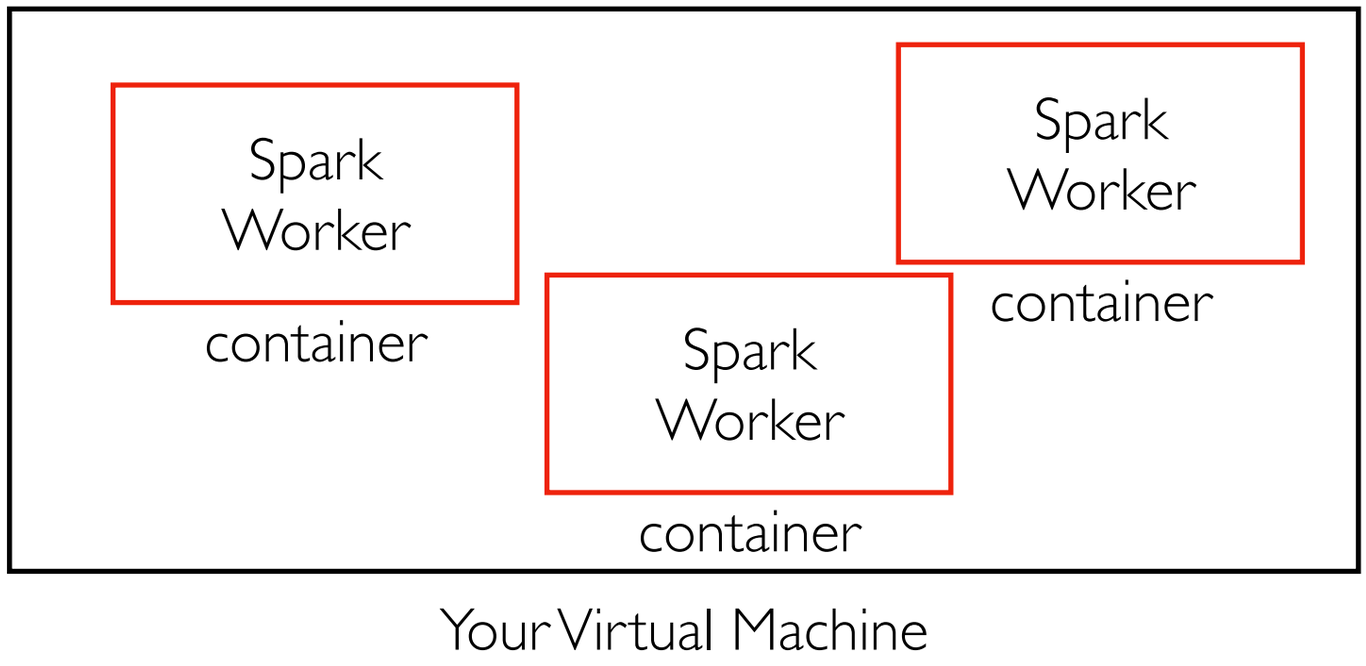
Containers and Virtual Machines are "Sandboxes"



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

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Demos

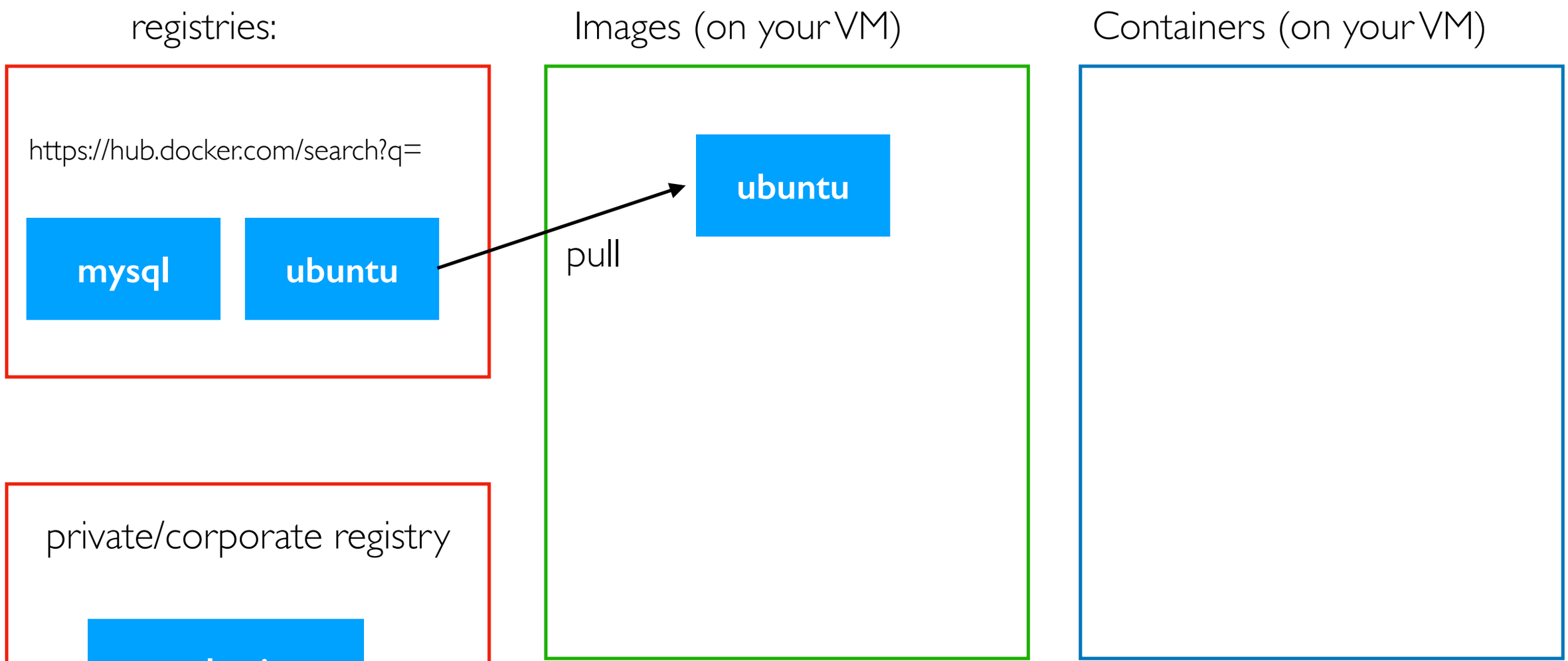
TIP: make notes of docker commands

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

Docker Install

See notes: https://github.com/cs544-wisc/f23/tree/main/p1#part-2-docker-install

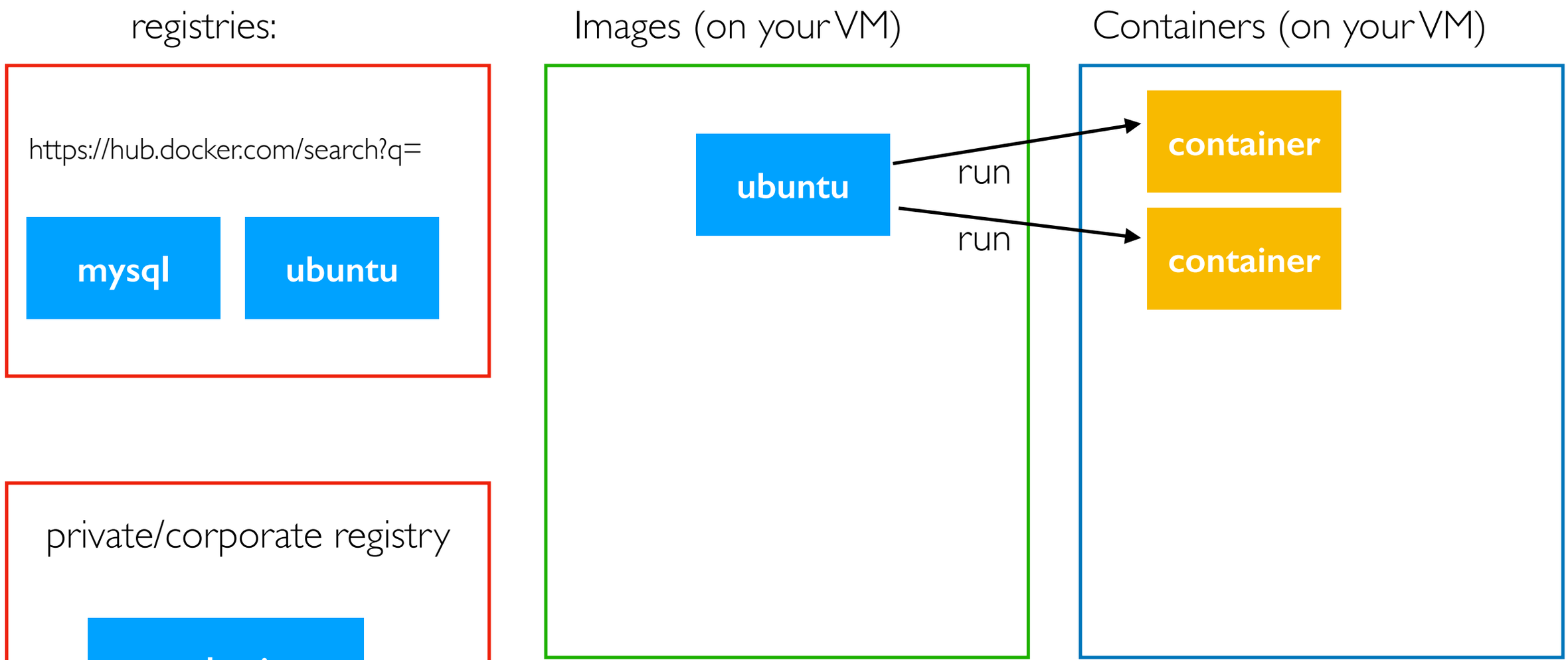
Registries, Images, Containers, and Dockerfiles



Images

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

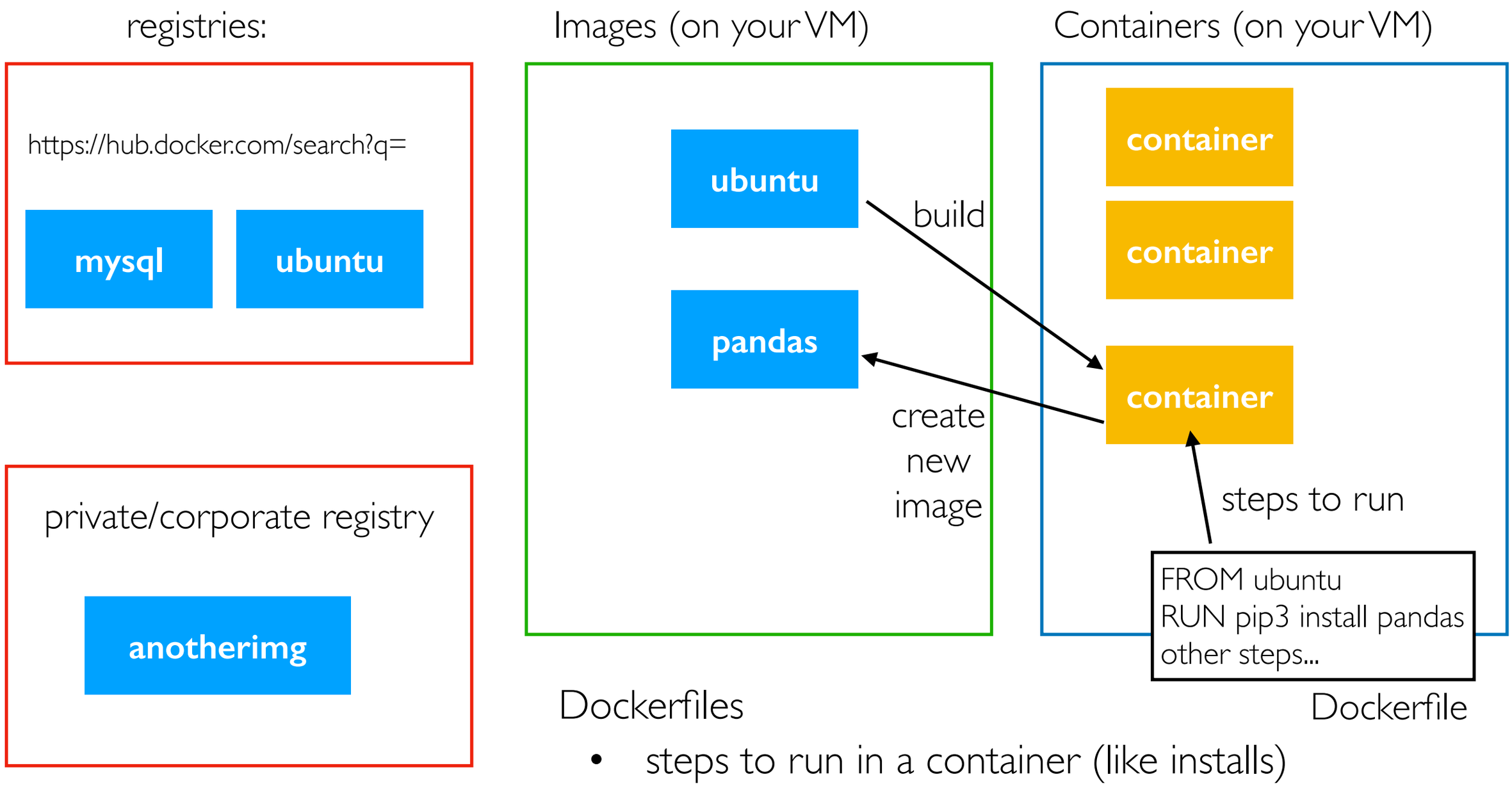
Registries, Images, Containers, and Dockerfiles



Containers

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

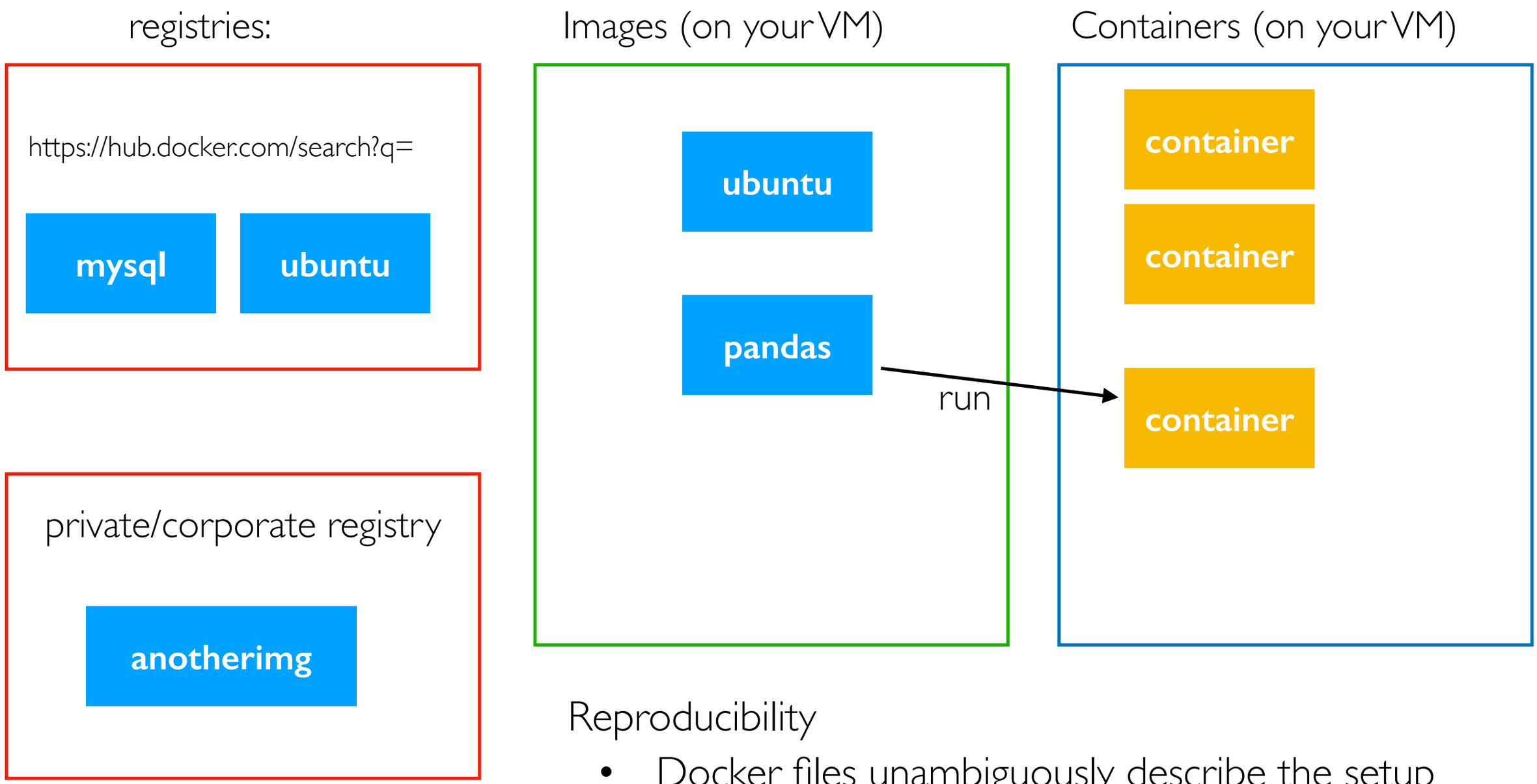
Registries, Images, Containers, and Dockerfiles



Dockerfiles

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

Registries, Images, Containers, and Dockerfiles



Reproducibility

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

Demos...