Lecture 4 - Introduction to Containers

DSE 512

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From Last Time

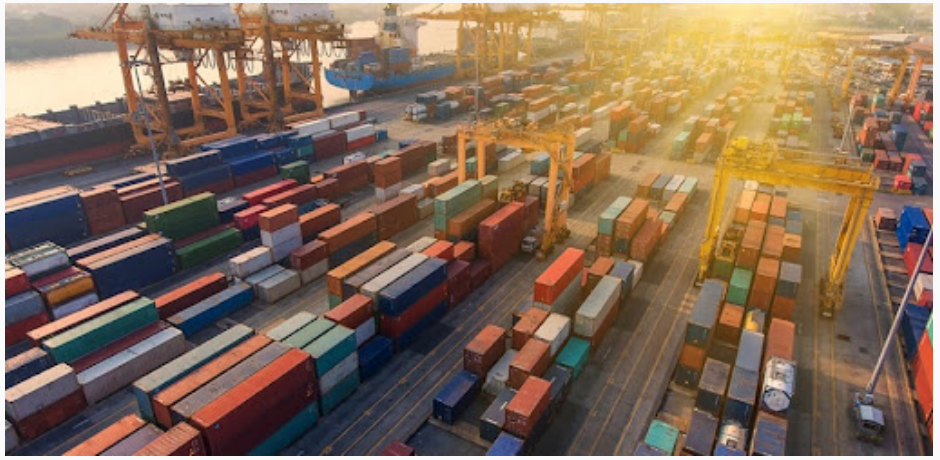
- Solved the example issue!
  - Ports, ports, ports
  - Posted discussion on Canvas
- Questions?

Containers

What is a Container?

> A Linux container is a set of one or more processes that are isolated from the rest of the system. All the files necessary to run them are provided from a distinct image.

Source: redhat.com



What is a Container?

A (binary) Linux program, shipped in a self-contained way.

History of Containerization

- 1980's: chroot
- 1990's: VM's
- 2000's: BSD Jails
- 2013: Docker
- 2016: Singularity
- 2016--Present: Kubernetes, OpenVZ, snap, flatpak, OpenShift, AND MANY MORE

Why Though?

Benefits

- Isolation
- Reproducibility
- Distribution

Common Uses

- Web services
- Dev environment
- CI builds
- Batch runs

- Building software is *really hard*
- Distributing software is ***completely impossible***

"Portability"

Randy Zwitch
@randyzwitch

The only solution for python packaging is to mail your working computer to whomever wants to use your package

11:58 AM · Jan 3, 2019 · TweetDeck

50 Retweets **306** Likes

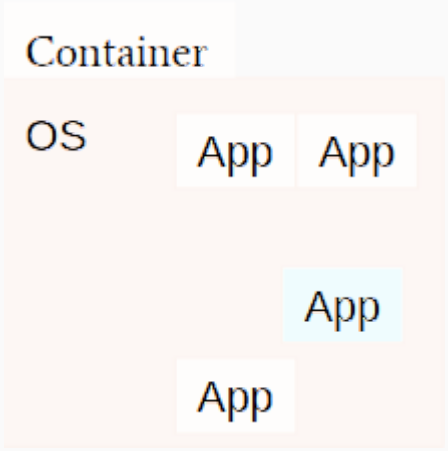
Why Should I Care?

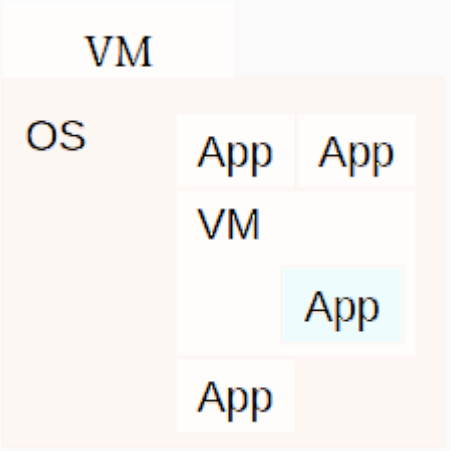
 In HPC, you don't have root! 

Container VS VM

Containers are

- Smaller
- Faster
  - Instant startup (same kernel, no boot)
  - Applications aren't virtualized; run *natively*
- Integrable with "host" OS





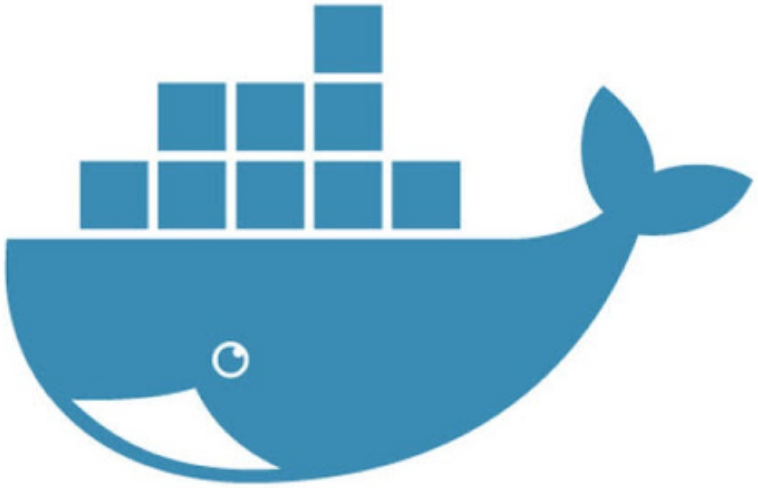
Container VS VM

A container is a normal program run in a funny way

A VM is an entire OS living inside your OS.

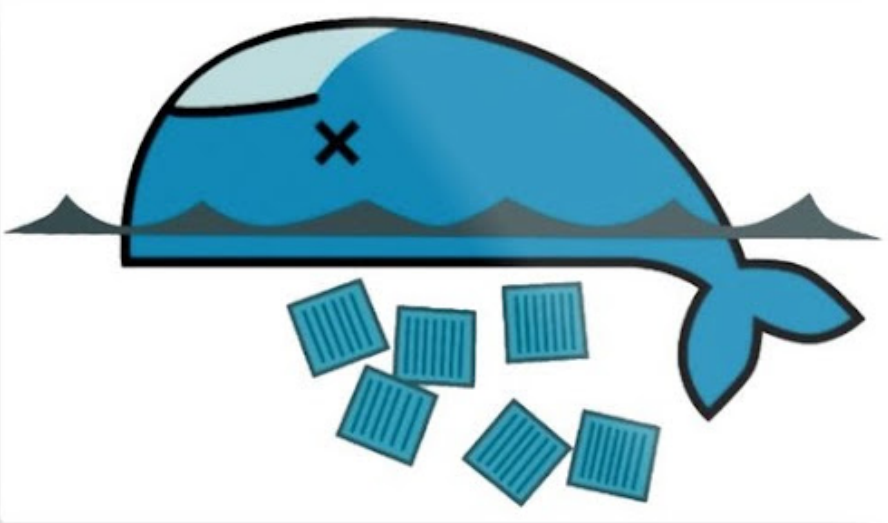
Docker

- Current hotness
- Pros
  - de facto standard
  - Incremental builds
  - Can be used on non-Linux (kind of)
  - Repos (e.g., Docker Hub, AWS ECR)
- Cons
  - Very enterprisey
  - Doesn't "feel" unix-y
  - Driver issues (MPI, CUDA, ...)
  - Security concerns



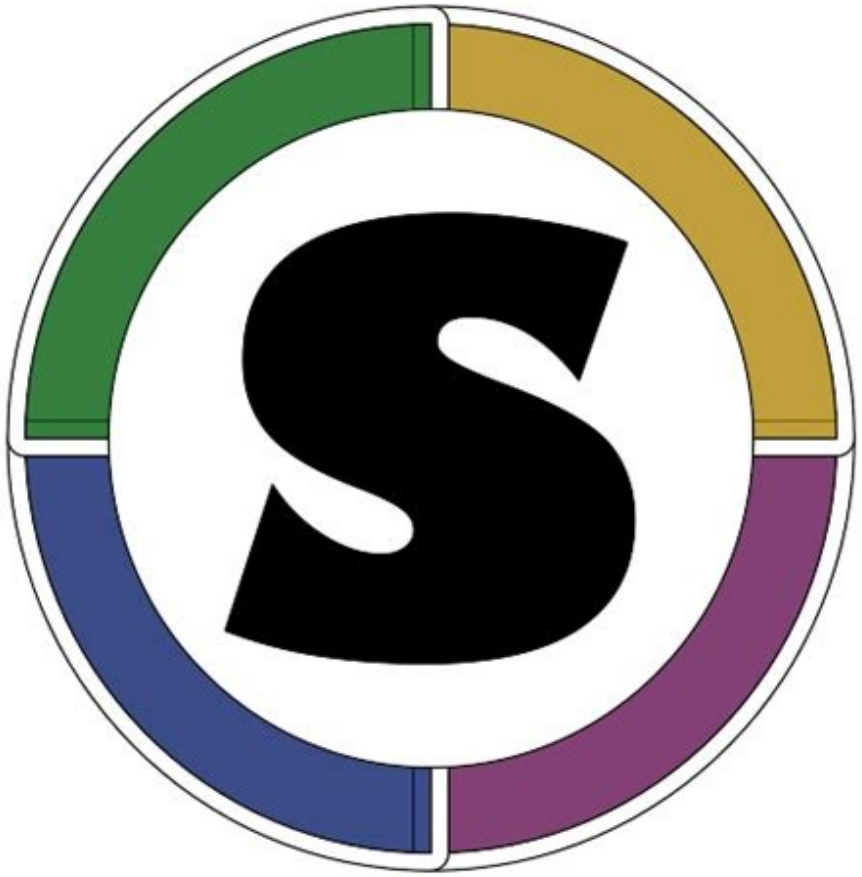
Docker All The Things?

- Builds are hardware specific
- Sharing files is painful
- Complex builds are, well, complex
- Can't use in HPC (e.g. ISAAC)



Singularity

- Containers for HPC
- Not docker
- Pros
  - Not docker
  - Can consumes docker images
  - Containers are FILES
  - Works great with NVIDIA
- Cons
  - Not docker
  - Monolithic builds
  - Singularity Hub
  - MPI can cause trouble



Live Demo