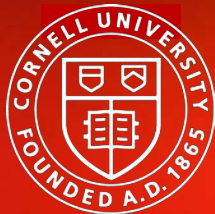


RESEARCH TECHNOLOGIES
UNIVERSITY INFORMATION TECHNOLOGY SERVICES



Center for Advanced Computing



Supporting Researchers with Containers:

Introduction to Containers

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Introduction

*...or how I learned to stop worrying and love ~~the bomb~~
containers...*



What are containers?

- *Born from a simple idea (chroot)*
- *Evolved over time into various forms of container services (e.g. BSD Jails, Solaris Zones)*
- *LXC (Linux Containers) was released in 2008*
- *Docker came on the scene in 2013*
- *Other technologies evolved – Shifter, CharlieCloud, Singularity*
- *Upping the ante – Docker Compose and container orchestration*



...and why would I want to use one



- *Consistency*
- *Portability*
- *Ability to package and run on HPC*
- *“Just in time” instantiation and updating on the fly*
- *Creating microservices*
- *Run legacy code/obsolete OSES*
- *Reproducible Science!*



Why bother with containers?

- *Consistency*
- *Reproducibility*
- *Easily integrate new applications (especially legacy applications)*
- *More easily manage many applications that may have complex requirements*
- *Portability of applications between gateways and individuals and HPC*



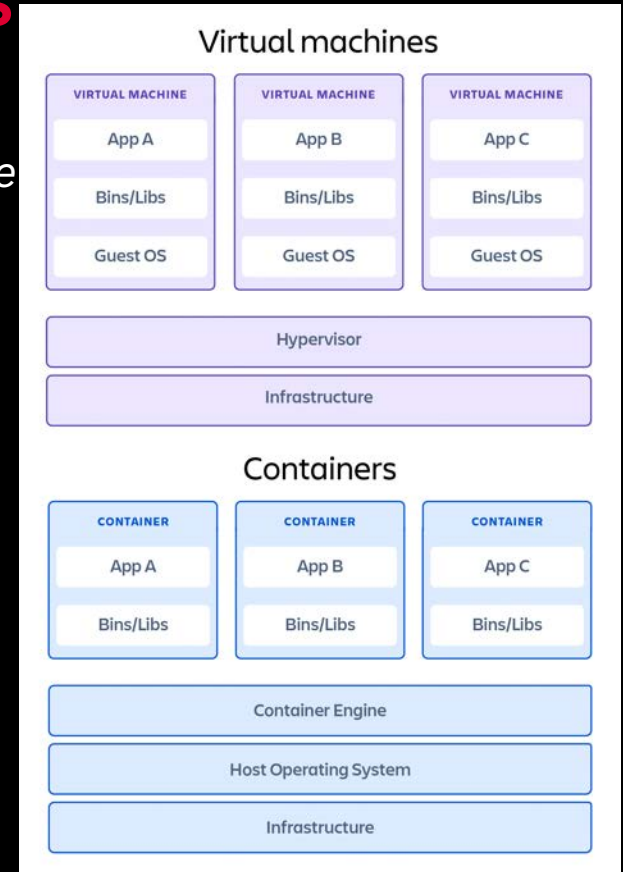
Containers vs. Virtual Machines

VMs:

- VMs are fully contained – everything you need is there
- VMs are independent of the host operating system
- All OS resources and tools are available

Containers:

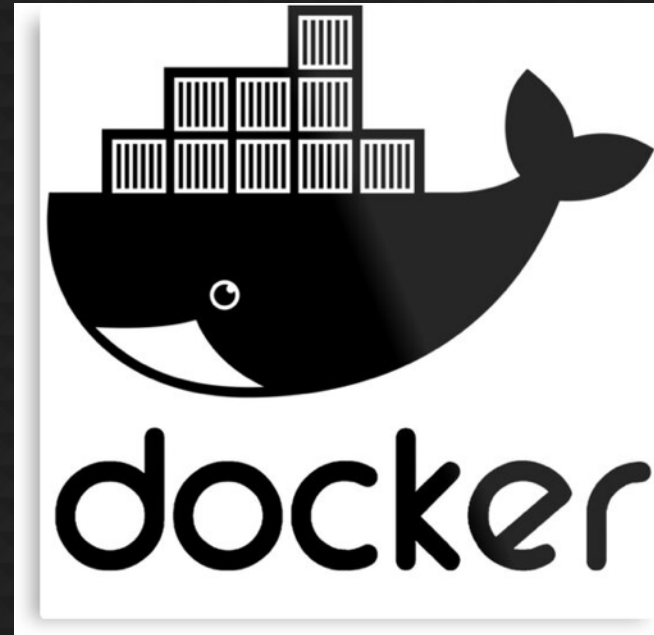
- Compact – minimal OS parts to run, rely on host
- Compact nature makes them more portable
- Robust ecosystem – many pre-made containers available



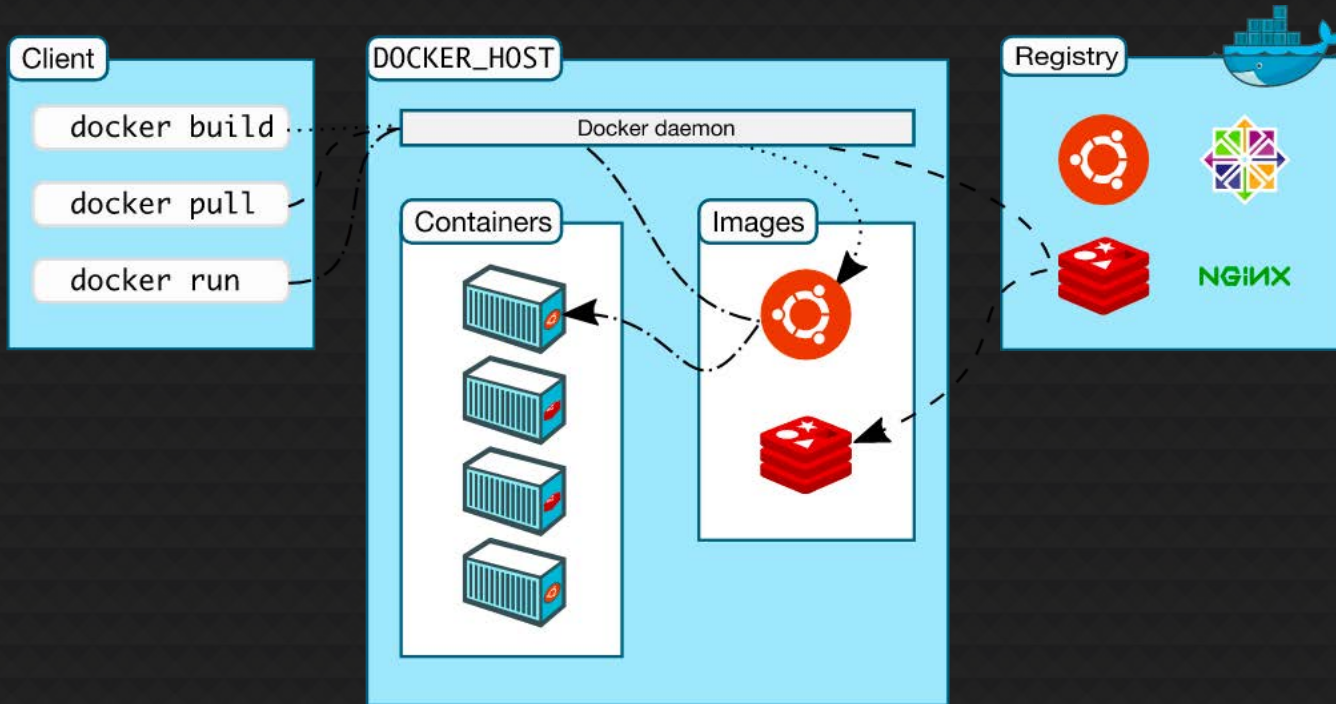
What is Docker

- *Docker is a container technology tool to create, deploy, and run applications*
- *Low overhead, uses the running kernel*
- *Lets a creator package all of the software needed to run an application in a reasonably compact and run it on any other Docker-capable machine***
- *Uses a client (`docker`) to talk over a REST API to the docker daemon (`dockerd`) either locally or remotely*
- *Has a large public repository of objects (containers, images, etc) at DockerHub -- and other repos are available*
- *It allows users to develop applications, package (ship) them into containers which can then be deployed anywhere*

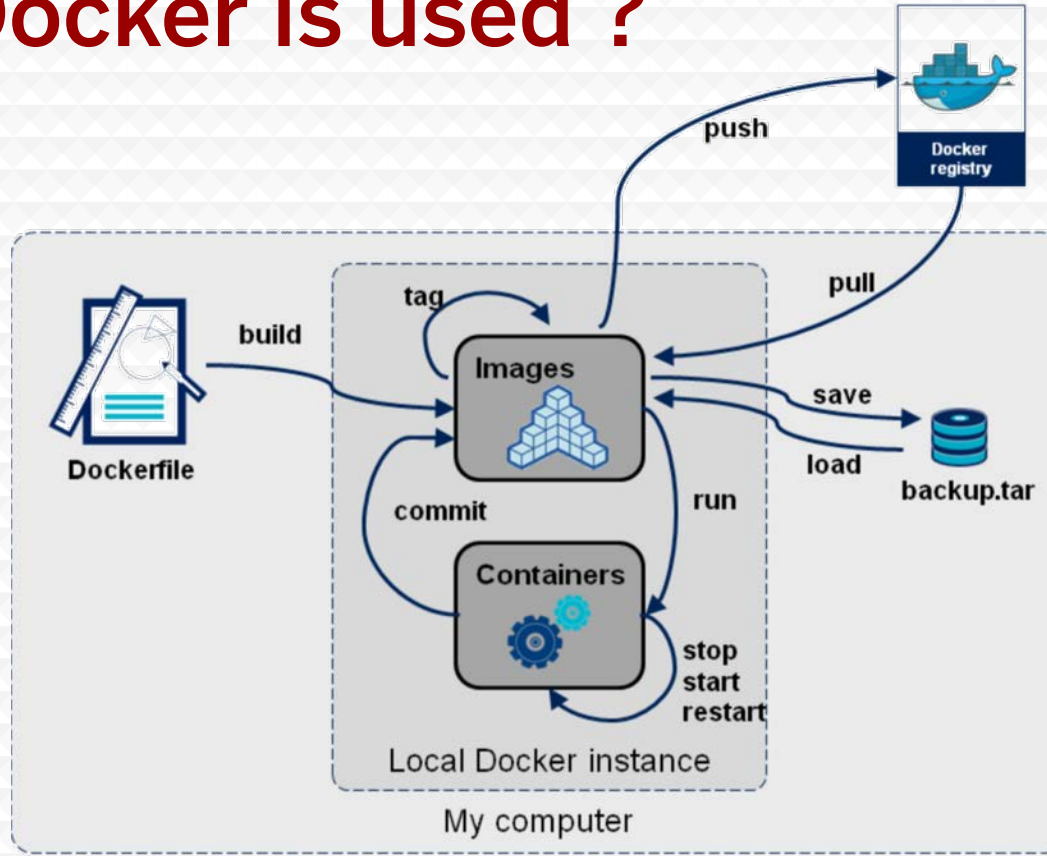
** Even Windows and Mac!



Docker in action...the big picture:



How Docker is used ?



What is Singularity?



- *YACP (Yet another container platform)*
- *Why are we talking about Singularity at all?*
- *How is it different from Docker?*
- *How does this all come together?*
- *Singularity can use Singularity containers from the Singularity Hub or Docker containers, even pulling from a Docker registry like Docker Hub*



XSEDE Cyberinfrastructure Resource Integration

- **Software toolkits, consulting services, provider coordination**
 - Cluster distribution, scientific software, XSEDE-like environment
 - Reproducible Container Template for science applications
 - Site visits to help implement campus clusters and clouds
 - Information and support for joining the XSEDE Service Providers
- **Impacts**
 - Growing number of campus clusters, more than 1000 TeraFLOPS of computing on CRI software
 - Virtual Cluster on Jetstream Cloud software
 - Container Tutorial at previous PEARC meetings, submissions for PEARC 21 and SC21 planned

Onward!

Supporting researchers with containers

Questions before moving on?

