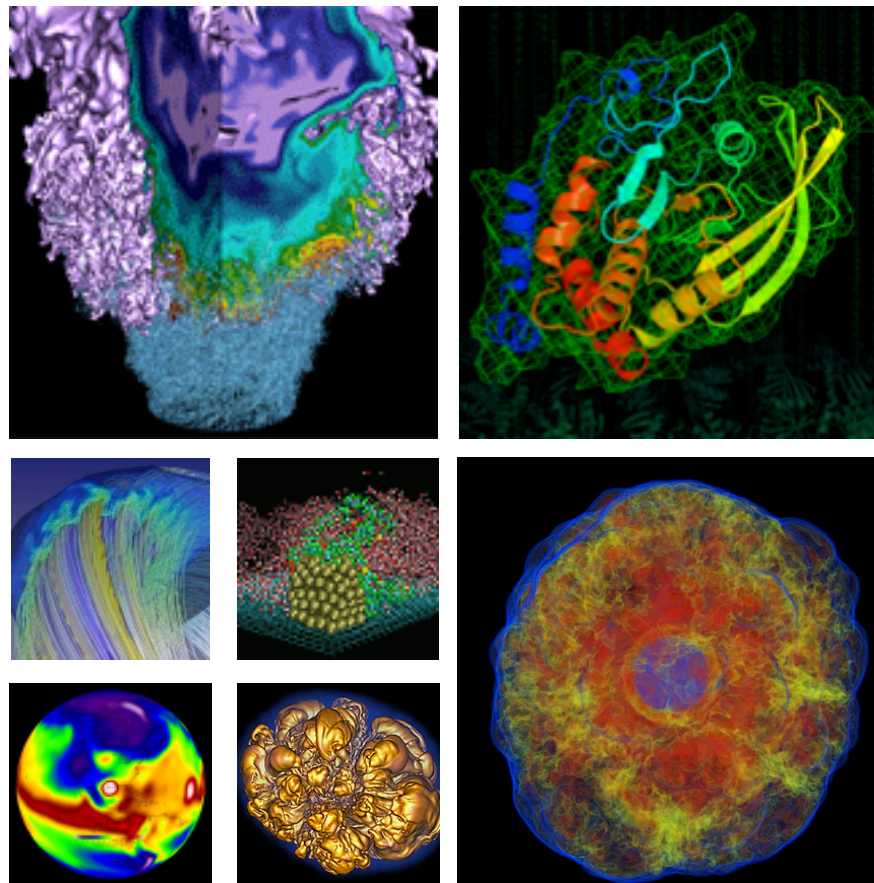


Into to Containers



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Problem Statement



- **Need a way to run isolated processes**
 - Resources
 - File system view
 - Process space
 - Network space
- **But should be lighter-weight than a virtual machine**
 - Avoid a separate kernel
 - Avoid a full running OS "stack" (e.g. system daemons)

Solution - Containers

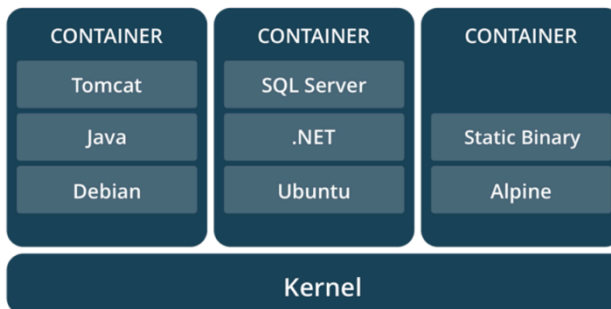


- **Uses a combination of Kernel “cgroups” and “namespaces” to create isolated containers**
- **Software to help define and manage containers**
 - 1979 – chroot introduced
 - 2000/2001 – FreeBSD Jails and Linux Vserver
 - 2006 – Process Containers (later became cgroups)
 - 2008 – LXC (cgroups and namespaces, no patches needed)
 - 2013 - LMCTFY (Google)
 - 2013 - Docker

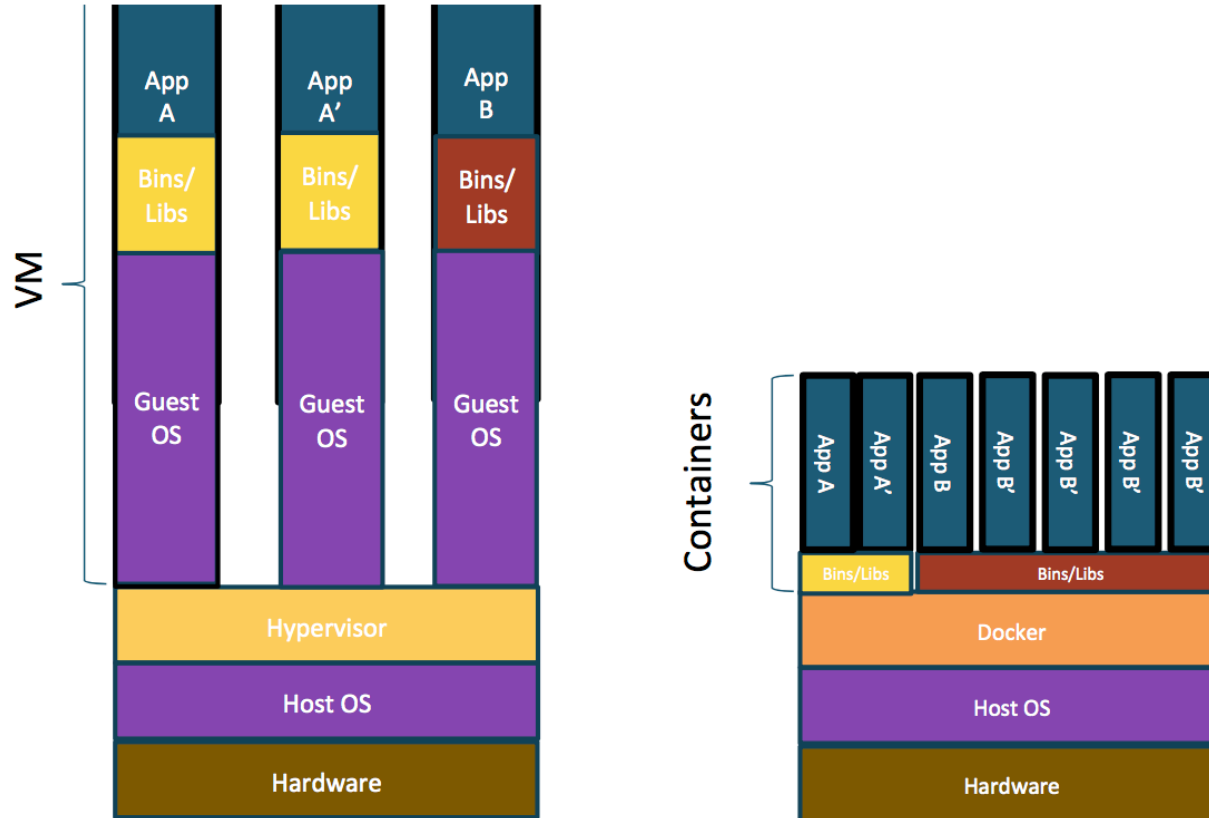
Why Containers?



- **Light weight, executable piece of software that contains everything you need to run it**
 - Code, system libraries and tools, environment, settings
- **All software and processes are isolated from their surroundings**
- **Portable**
- **Typically used for single instance programs**



Containers and System Administration



Docker Basics



Build

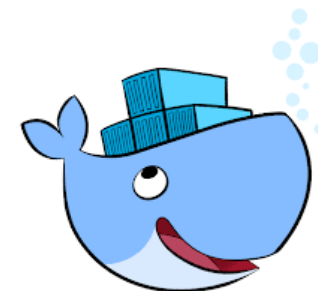
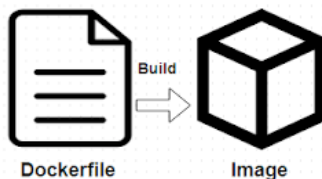


Ship



Run

- Build images that captures applications requirements.
- Manually commit or use a recipe file.
- Push an image to DockerCloud, a hosted registry, or a private Docker Registry.
- Share Images
- Use Docker Engine to pull images down and execute a container from the image.



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Docker: Container Orchestration

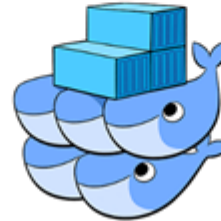


docker

containers



swarm



compose



Now offering a product that will handle complex multi-container deployments across multiple nodes (swarms).

Open source version Moby also available

Complex deployment of (mostly web) services



- **Reproducibility**
 - Everything you need to redo a scientific analysis
 - Image manifest contains all information about environment
 - Scripts, portable input files can be managed with version controller for greater control
- **Portability**
 - Runs on every system
- **Reduction of Effort**
 - Compile takes 10 hours? Just do it once and share it with everyone
 - System doesn't have the right library version? Yum install it yourself in the container

What's in an Image



- **Directory tree**
 - Base Linux OS
 - Libraries, binaries, tools, scripts, etc
 - User code
 - Data
- **Run-time Settings**
 - Environment variables
 - Working Directory
 - Default execution and parameters
- **Other things**
 - Network-related (e.g. ports)
 - Run User



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