Containers and Some Odds and Ends About Computational Infrastructure

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Follow Along at:

- https://opensciencegrid.github.io/dosar/Materials/Materials/

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What are containers?

- Operating System Level Virtualization
  - Lightweight, providing the minimal level of overhead for the application to function properly.
  - Super minimalist VMs
  - No Hypervisor
  - Abstracts away the operating system and hardware
  - Share the OS Kernel with other containers
  - Container size is very small and therefore quick and easy to provision

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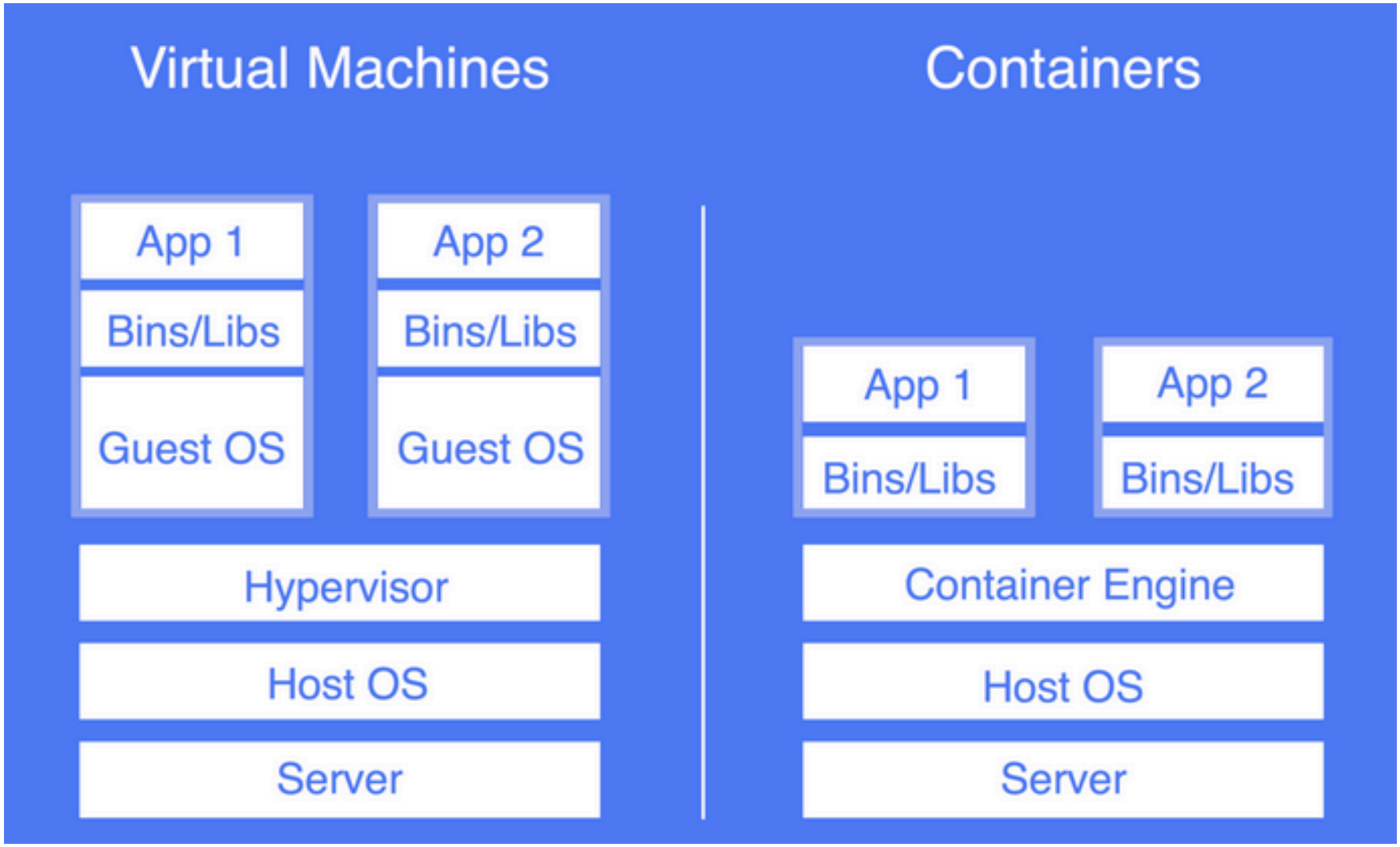
How do they differ from VMs?



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More differences…

- Size
  - Containers are usually 10s of MB
  - VMs can be several GB
- Shared hypervisor vs. shared kernel
- VMs have their own kernels so a deeper level of isolation
- Containers virtualize the OS while VMs virtualize the hardware

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Container Advantages

- Size
- Less resource intensive
- Quick provisioning
- Easy allocation of resources
- Quicker development cycles
- Cost effective
- Very good for microservices

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Container Disadvantages

- Security – shared kernel with root access
- Less flexibility in OS
- Networking can be tricky
  - Properly configuring sufficient networking resources is challenging

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Container Software

- Docker
- Singularity
- LXC, LXD
- Solaris Zones
- RKT
- BSD Jails
- chroot

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A quick review

Computing Infrastructures

- Local Laptop/Desktop – Short jobs with small data
- Local Cluster – Larger jobs and larger data but subject to availability
- HPC – Prime performance with parallelized code
- HTC – Sustained computing over a long period for serialized workflows
- Cloud – Need deeper permission on an OS and/or have deeper pockets

Some Examples of Academic CIs Worldwide

- HTC
  - EGI (formally European Grid Initiative)
  - OSG (Open Science Grid)
  - ASGI (Asia Pacific Grid Initiative)
  - NorduGrid
  - Earth System Grid (ESG)
  - Many other regional and national infrastructures

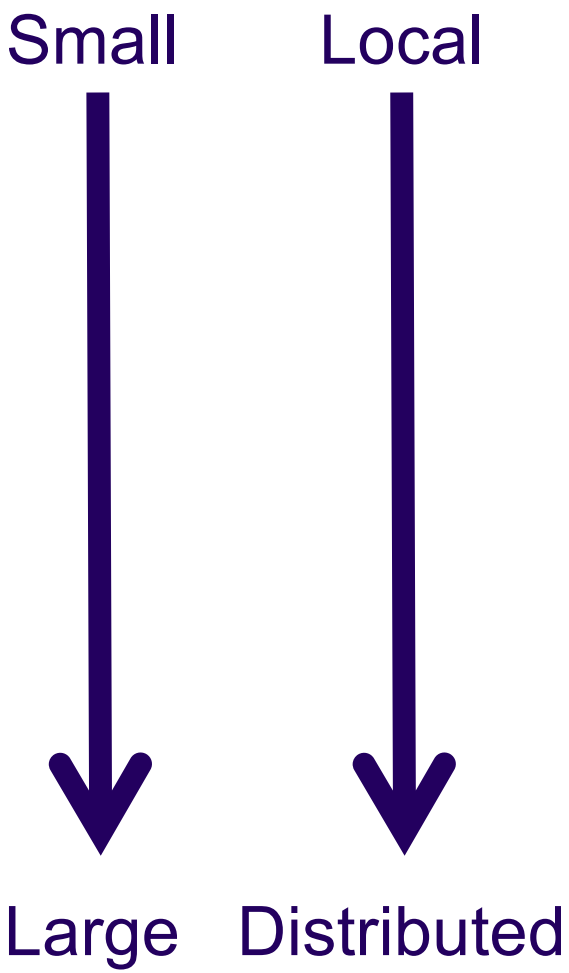
Some Examples of Academic CIs Worldwide

- HPC
  - XSEDE (eXtreme Science and Engineering Discovery Environment)
  - PRACE (Partnership for Advanced Computing in Europe)
  - Compute Canada
  - Greek Research and Technology Network (GRNET)
  - Centre for HPC (South Africa)
  - Many other national infrastructures

Some Examples of Academic CIs Worldwide

- Cloud
  - EGI Federated Cloud and EOSC
  - NeCTaR – National eResearch Collaboration Tools and Resources
  - Jetstream (Part of XSEDE)
  - SwissACC (Swiss Academic Computing Cloud)
  - Many other national cloud infrastructures

Let's take one step at a time



- Can you run one job on one computer?
- Can you run one job on another computer?
- Can you run 10 jobs on a set of computers?
- Can you run a multiple job workflow?
- How do we put this all together?

This is the path we'll take

What happens when you go home?

- DOSAR: Distributed Organization for Scientific and Academic Research http://www.dosar.org/
- You are welcome to join our bi--weekly video (Vidyo) meetings. Send request to be added to DOSAR email list to Prof. Greenwood: greenw@phys.latech.edu reference you attended the Data Science Summer School in Trieste
- If you want long-term grid access, you can request membership in the DOSAR VO

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Questions?

- Questions? Comments?
  - Feel free to ask me questions now or later:

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Exercises start here:

- https://opensciencegrid.github.io/dosar/Materials/Materials/

Presentations are also available from this URL.

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