

## Objectives

- Virtualization
- Docker

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## Review: Virtualization

- What is virtualization?
- What are benefits of hardware virtualization?
- What are the components of hardware virtualization?
  - E.g., What is the hypervisor/VMM?

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## Review: Hardware Virtualization

- Abstracts underlying physical hardware from operating systems and applications
- Allows multiple guest operating systems to run in parallel
- Physical resources are shared among all guest OS and virtualization software

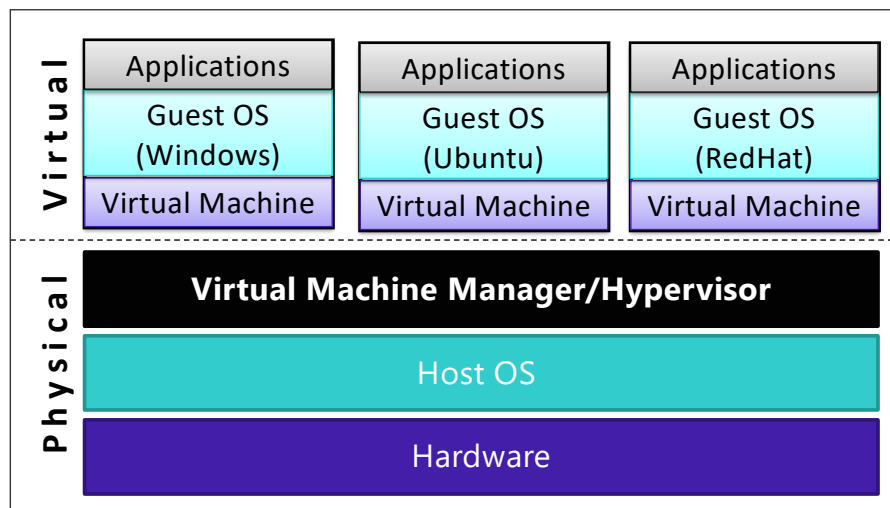
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## Review: Virtualization Architecture



Hypervisor: The supervisor's supervisor (the operating system)

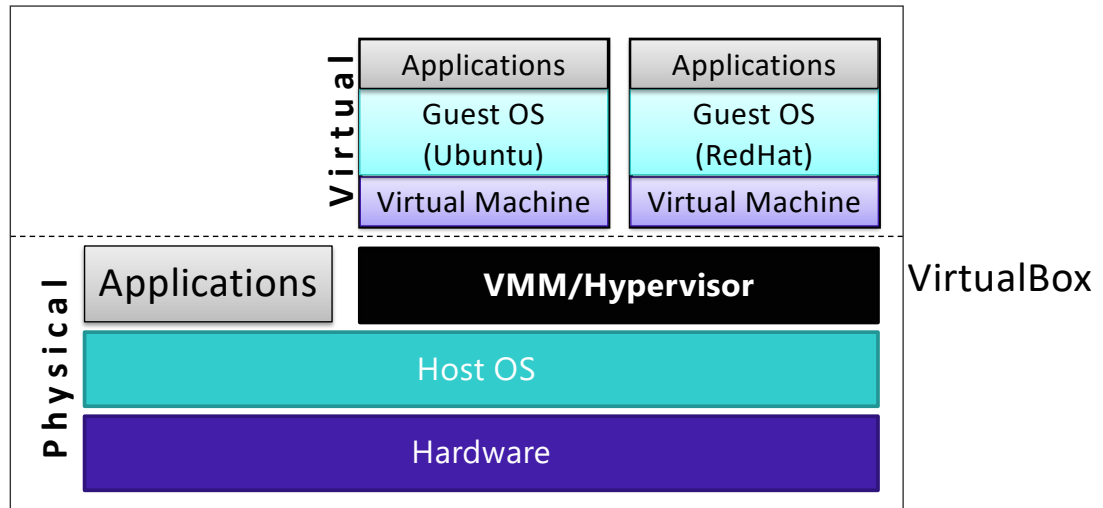
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## Alternative Virtualization Architecture



Hypervisor: The supervisor's supervisor (the operating system)

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## Review: Benefits

- Fewer servers, with better system utilization
  - Sharing of pooled resources
- Easier redundancy and disaster recovery
  - Migrate VM to another machine
- Decreased downtime
- Isolate VMs from each other
  - Testbeds
  - No worries about conflicts in applications

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## Reminders for Professor Sprenkle

- Smart cooling of data centers:
  - It's being green!
  - But, mostly, it's cheaper!
- Why need both a Host OS and the VMM/Hypervisor?

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## CONTAINERS

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# Containers

- Container  $\neq$  VM
- Run a process with a restricted view of system resources
  - Hide other processes
  - Limit access to system resources
  - Isolated
  - Packages up code and dependencies
- Not full virtualization
  - Process must use existing kernel and OS
- Lightweight (compared to VM)
  - Don't need separate OS

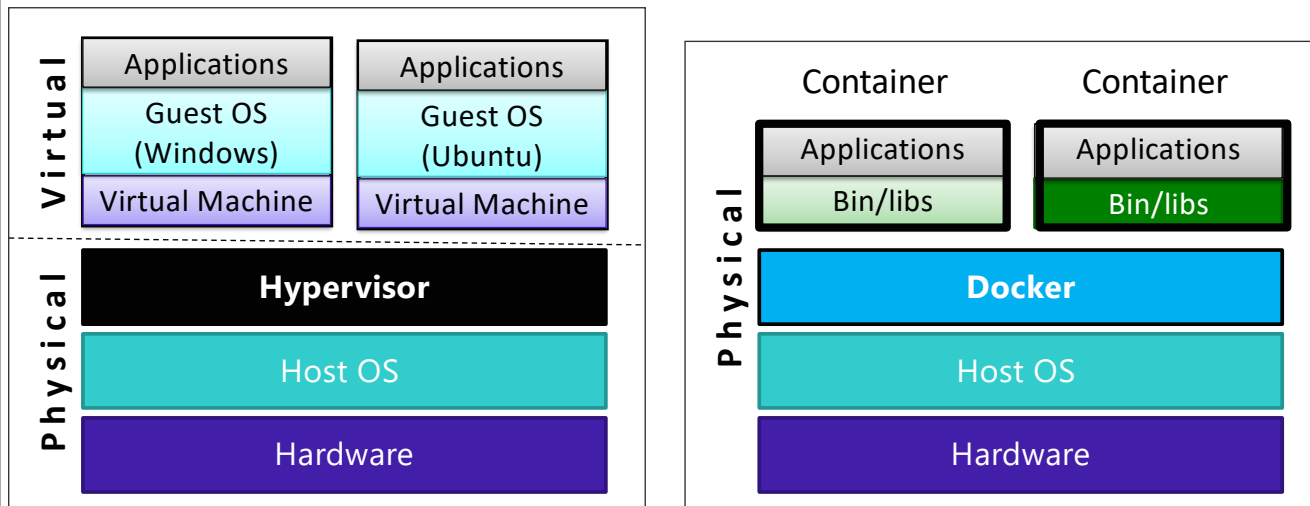
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# Virtual Machine vs Container



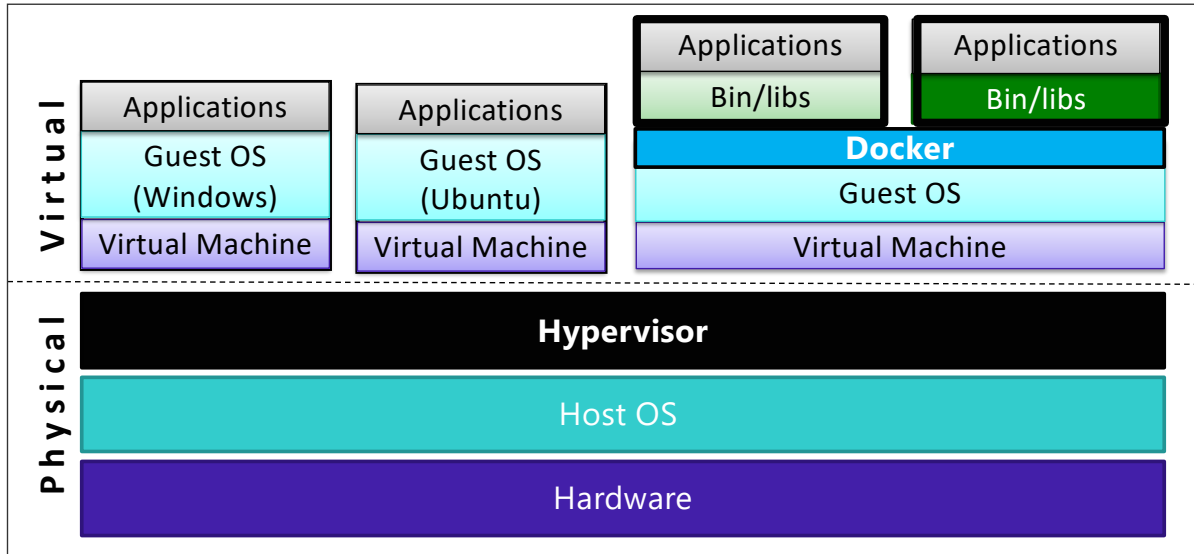
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## Not Mutually Exclusive



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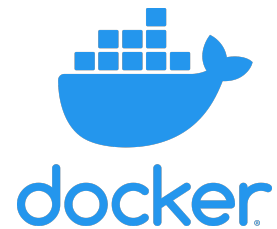
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## Docker

- Provides an interface on top of underlying containerization designs
  - Popularized containers
  - Interesting case in commercializing existing OS functionality
- Packages a filesystem in a docker image
  - Provides more of a “virtual machine” notion
  - But processes still running on existing kernel



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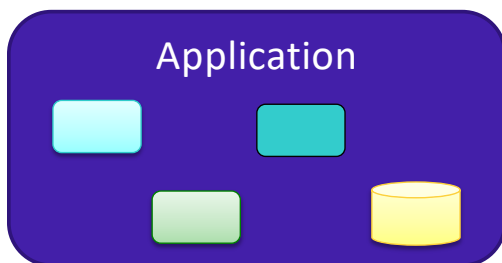
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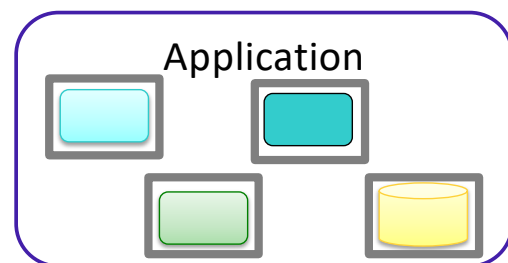
## Break Applications Down

- Rather than one monolithic application
- Break it into services
  - Each service can be separately scaled
  - Don't need to worry about dependencies



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## Docker Images

- Docker Hub
  - Repository of docker images
- Dockerfile
  - Create your own image

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## Data Center Tour?

- Fri, Mar 11 or Mon, Mar 21?
- Break into two groups of ~10 people
  - 12:20-12:40
    - Better for students who don't have class from 11-12.
  - 12:40-1:00

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## Looking Ahead

- Vote and sign up for data center tours
- Email Sprenkle with Docker issues
- Assignment 1 is due Thursday night
  - Reload the assignment page for updates/clarifications

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