Docker Fundamental

Course Introduction

What We'll Learn

Linux Containers

- Containers vs Virtual Machines << **FIGHT!!**
- Kernel namespaces, cgroups, Capabilities…

Docker Engine

- Execution Driver: libcontainer vs LXC
- AUFS, OverlayFS, Device Mapper…

Docker Images

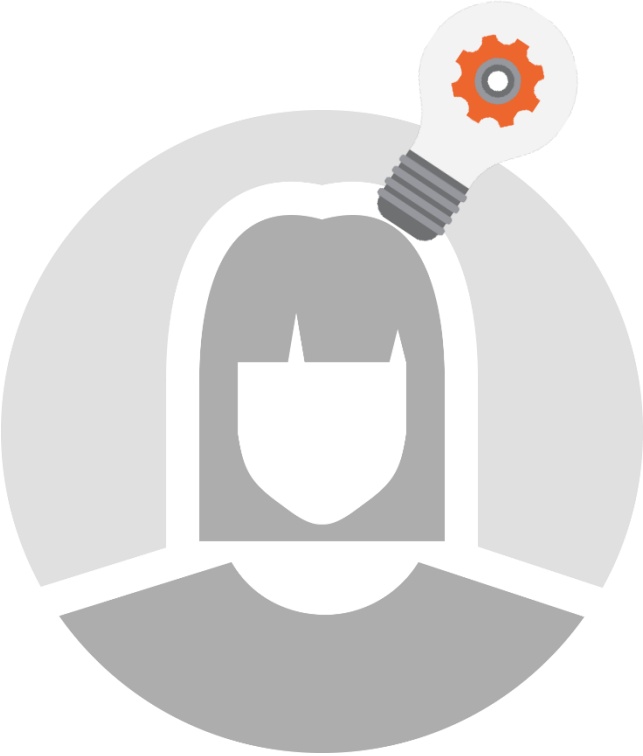
- `docker build | docker images | docker inspect…`
- Union mounts, Layering, Dockerfile

Docker Containers

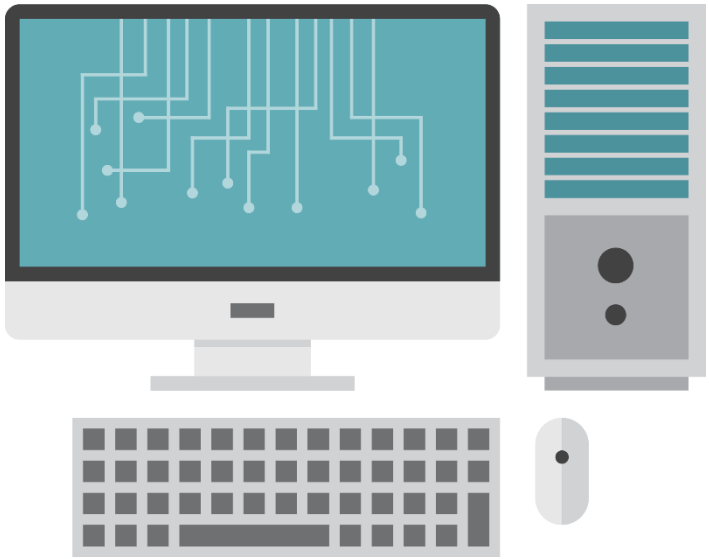
- `docker start|stop|restart`

Registries, Volumes, Networking….

Prerequisites



- Basic computer knowledge
- Do **not** need to be a Linux expert!



- 1 – 2 Linux machines (can be VMs)

Introducing Containers

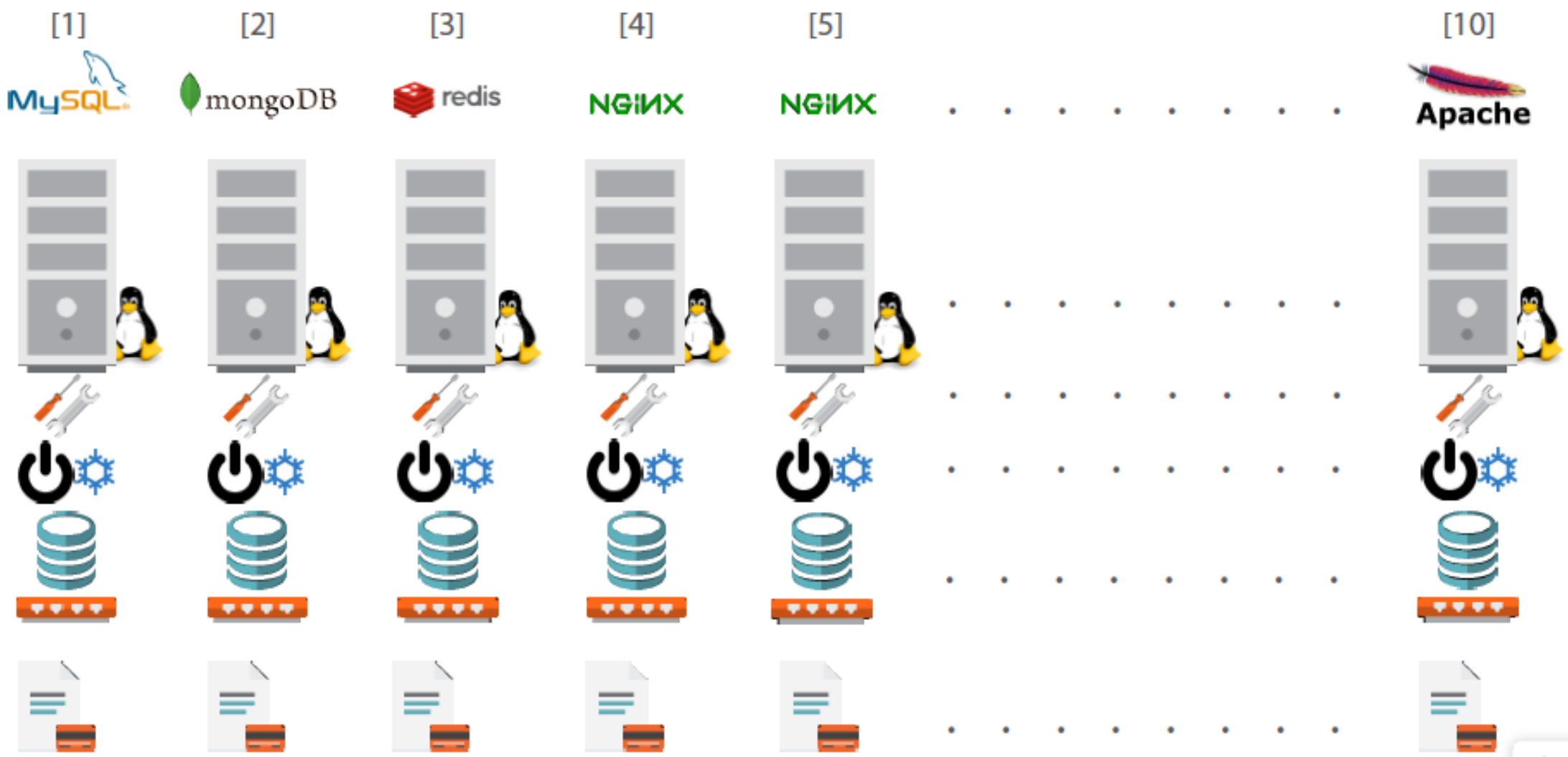
It’s all about **applications**

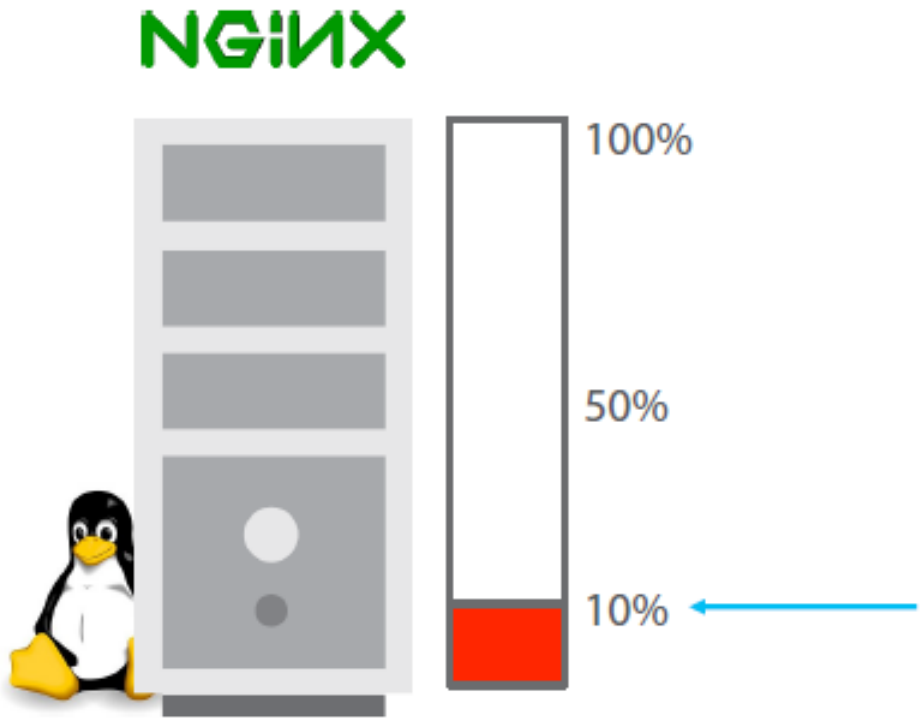
server : application

1 : 1

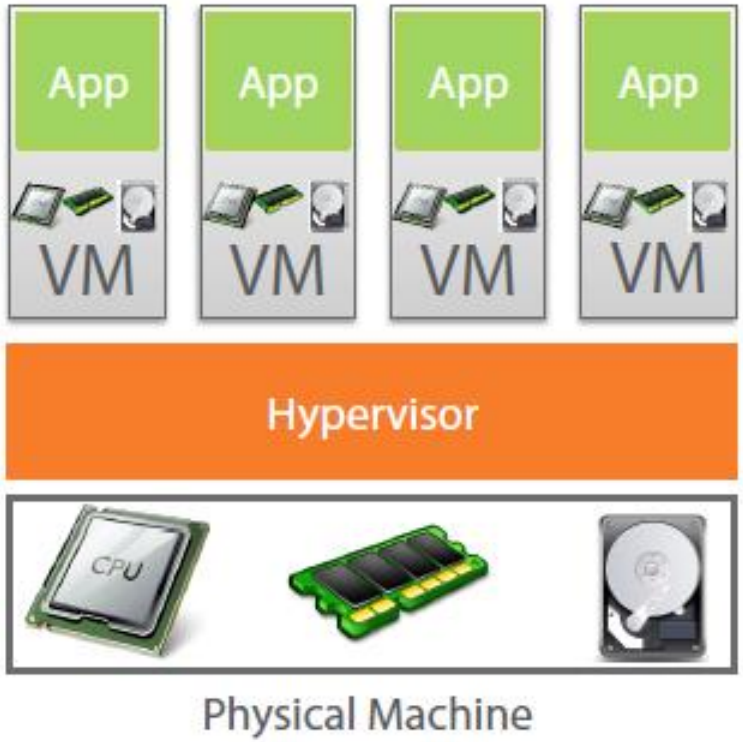
server : application

1 : 1





KVM vmware Xen™


App
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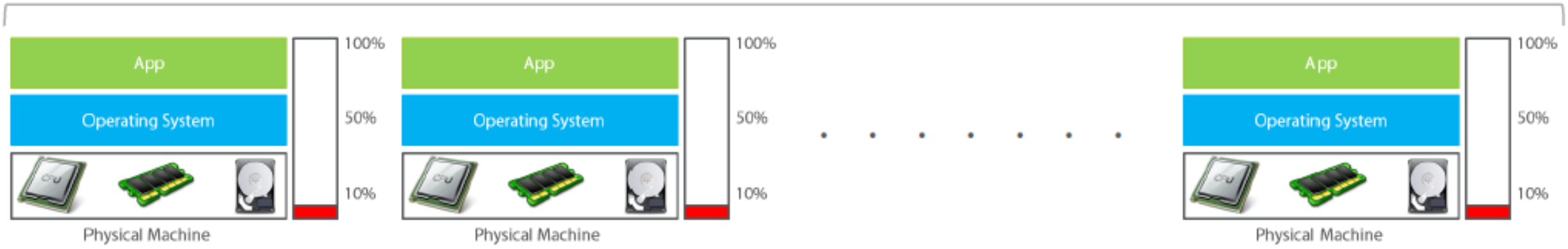
VM
VM
VM
VM
Hypervisor
CPU
Physical Machine

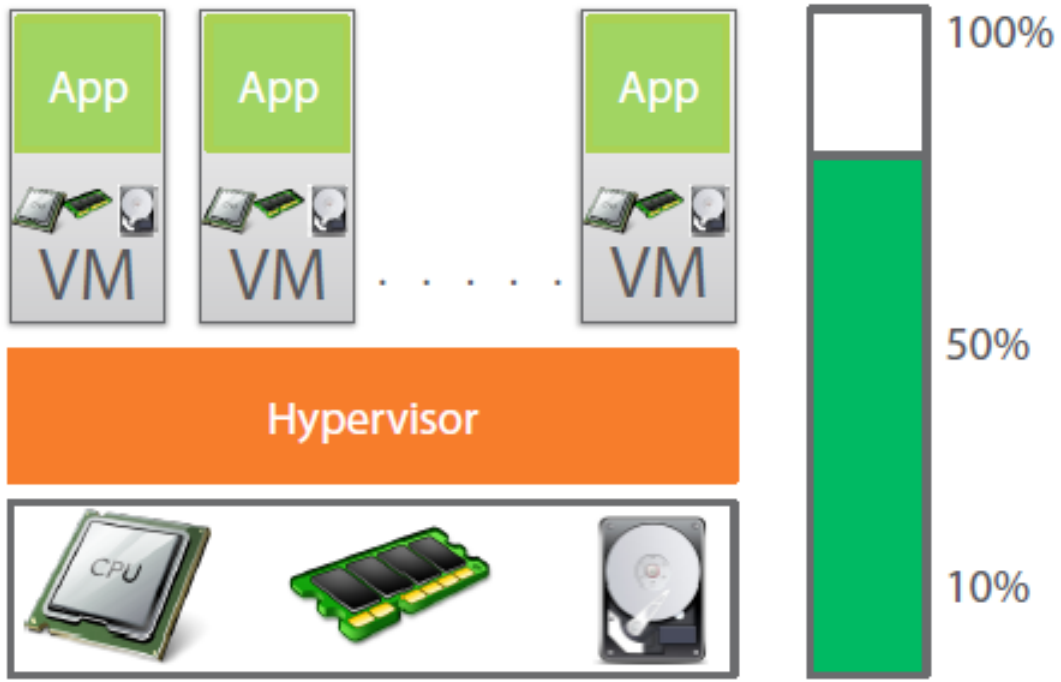
10 x Apps | 10 x Physical Machines | Less than 10% utilization

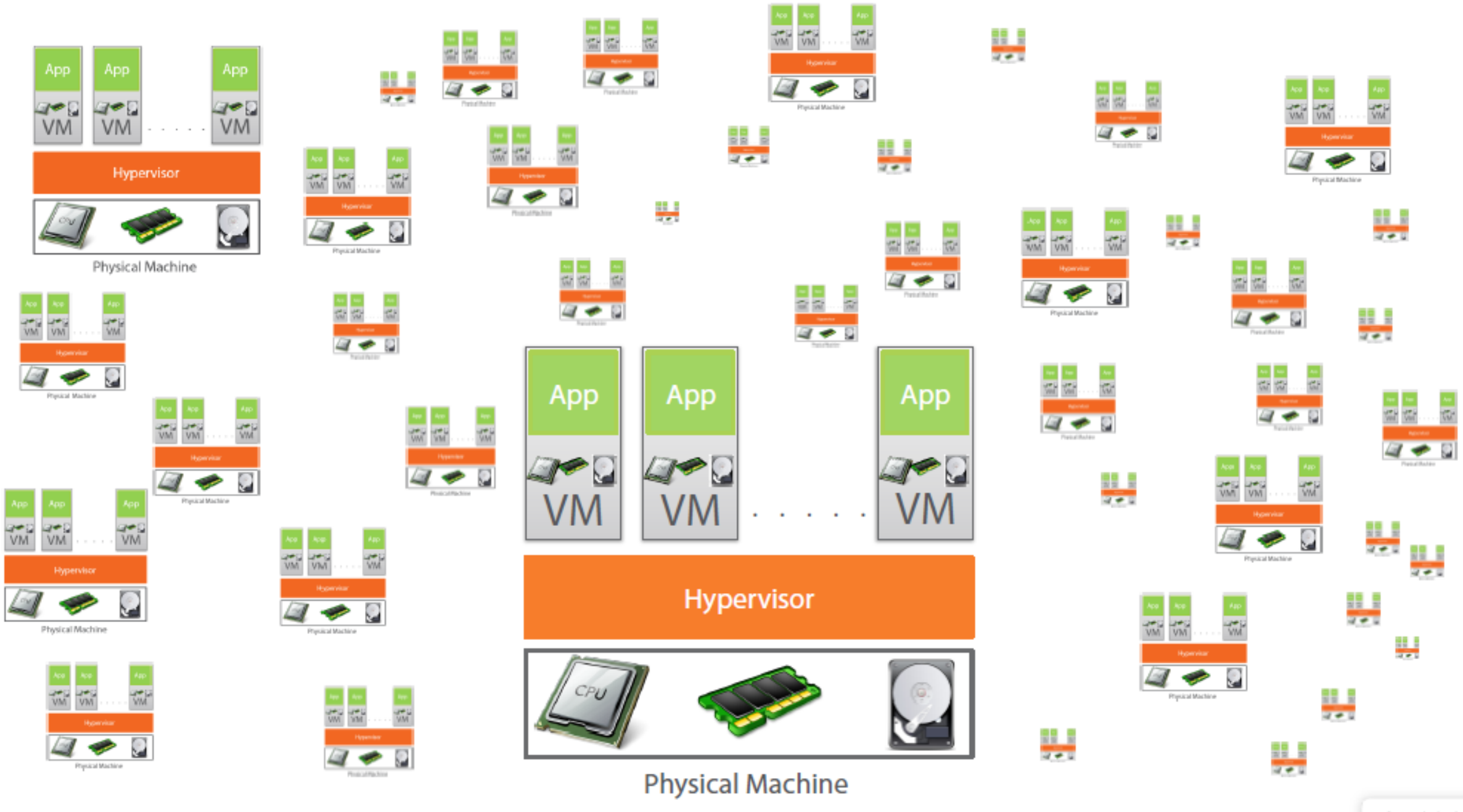


10 x Apps

1 x Physical Machines

~80% utilization




App
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Physical Machine
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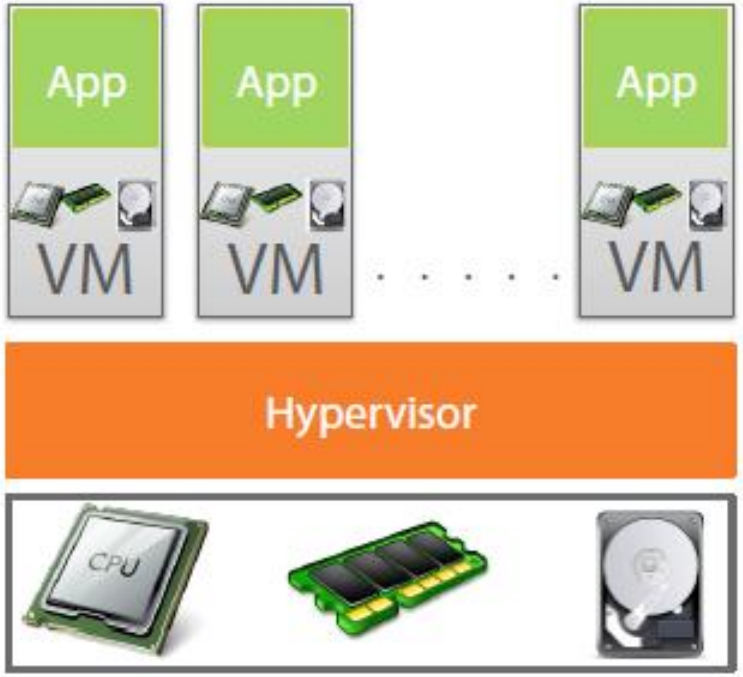
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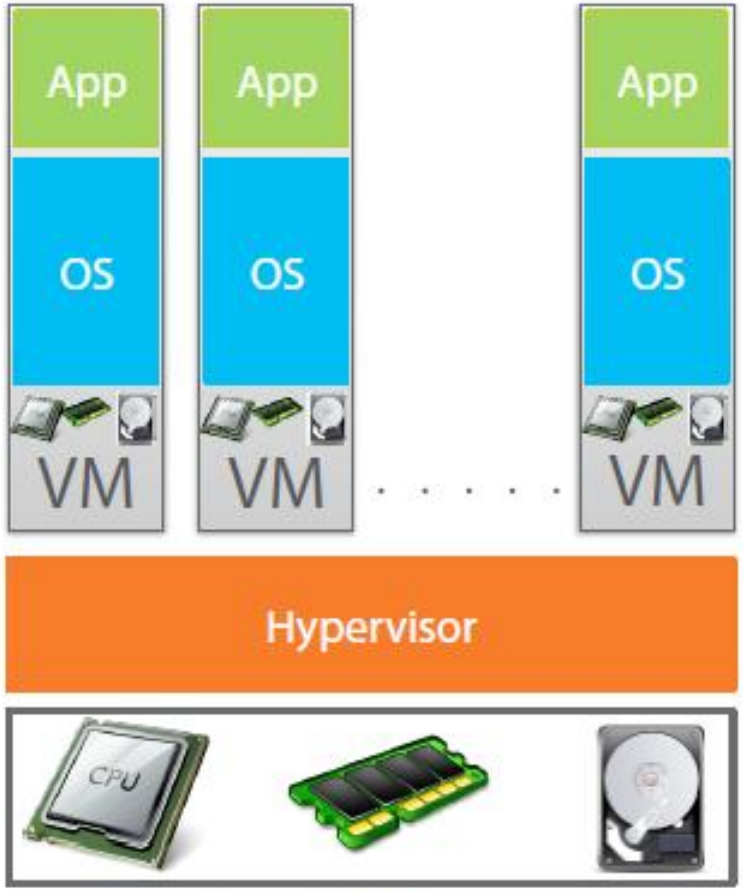
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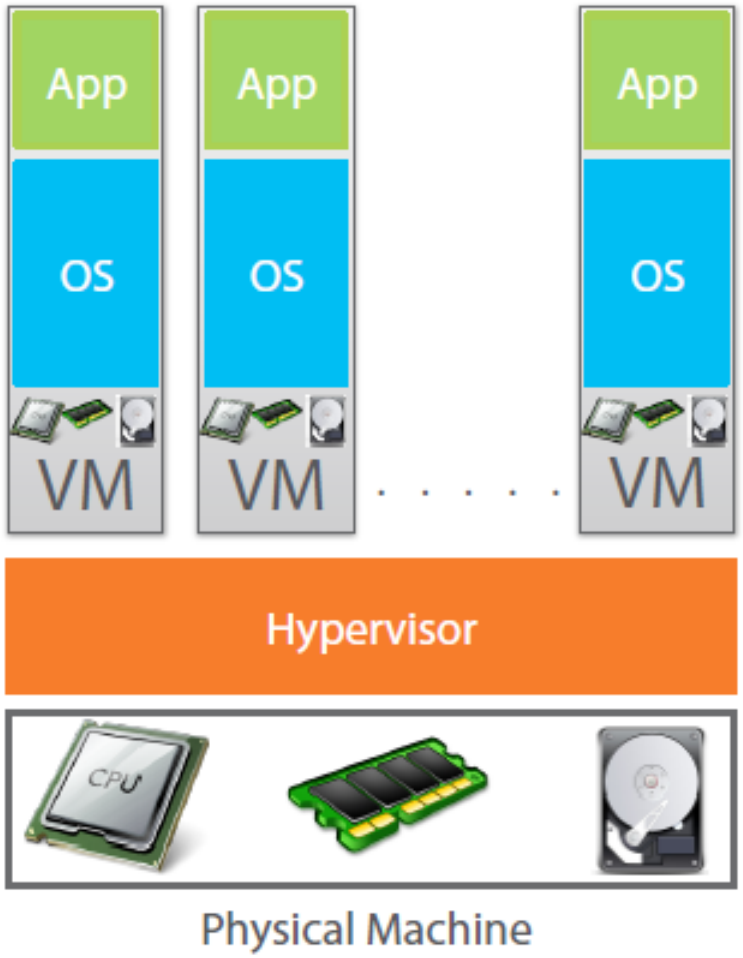
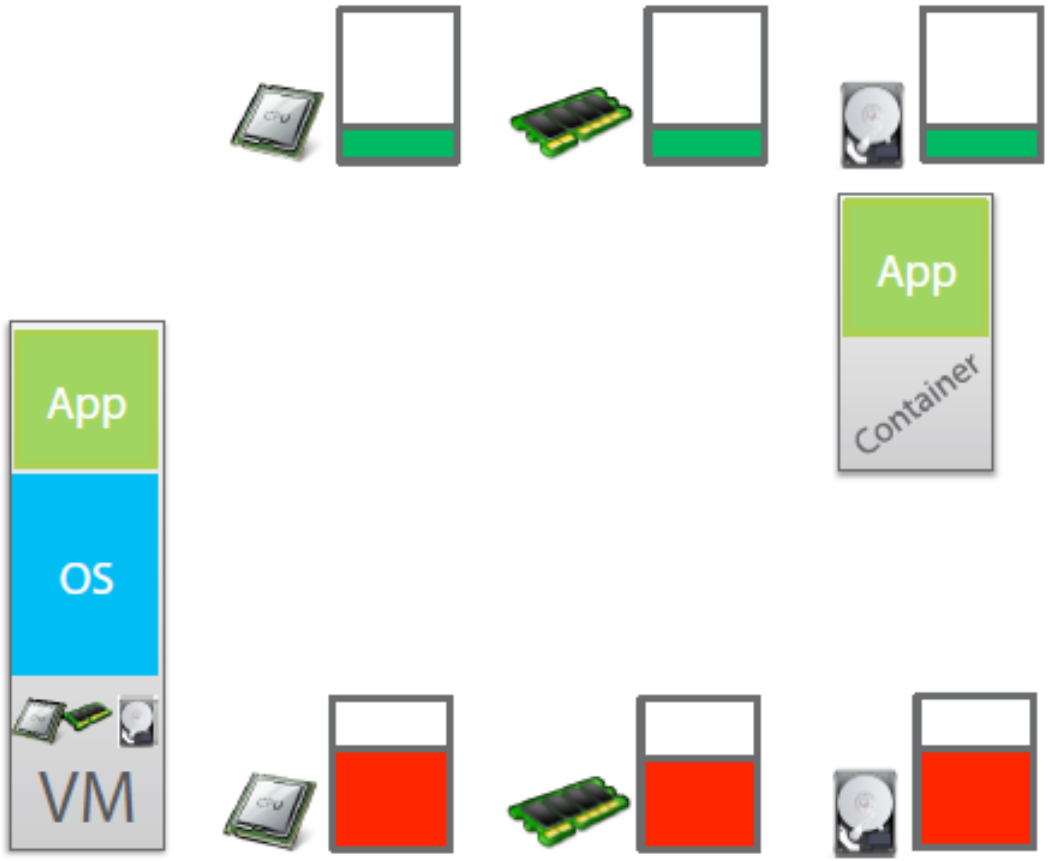
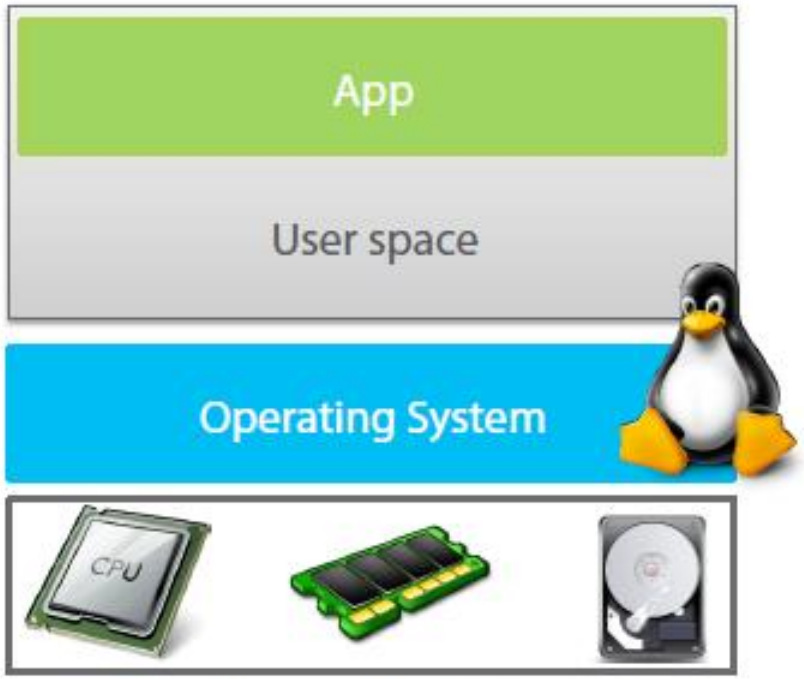


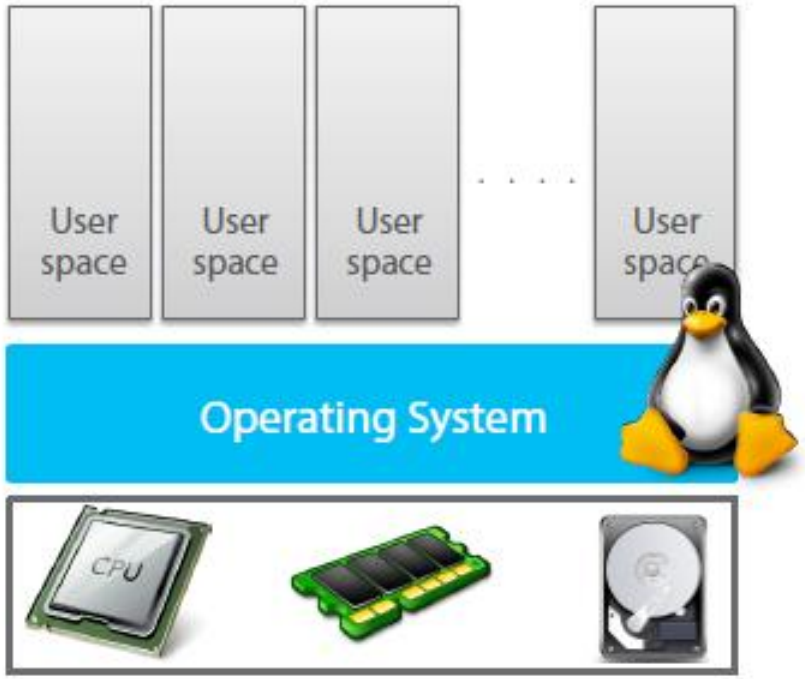
> OS != Business Value



Containers are more lightweight than Virtual Machines



Physical Machine



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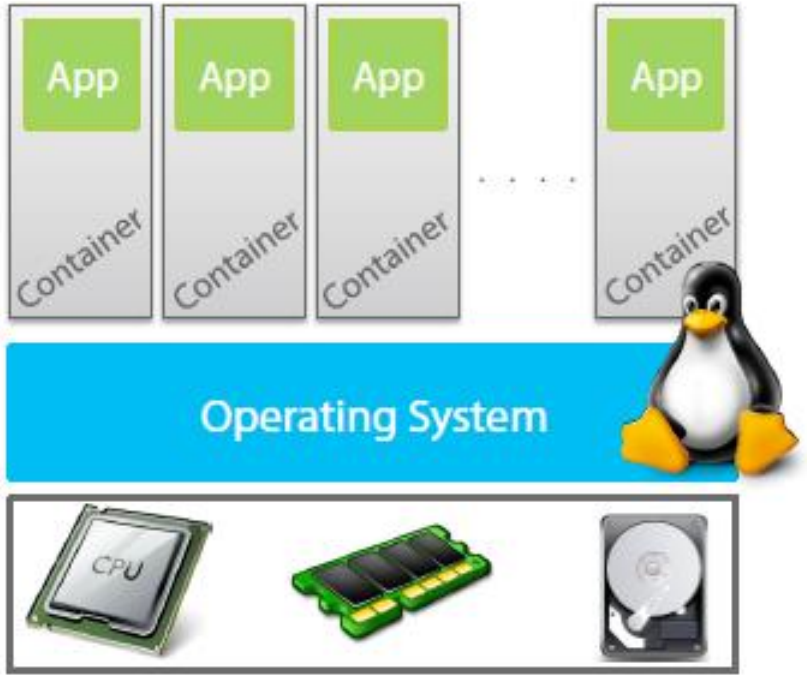
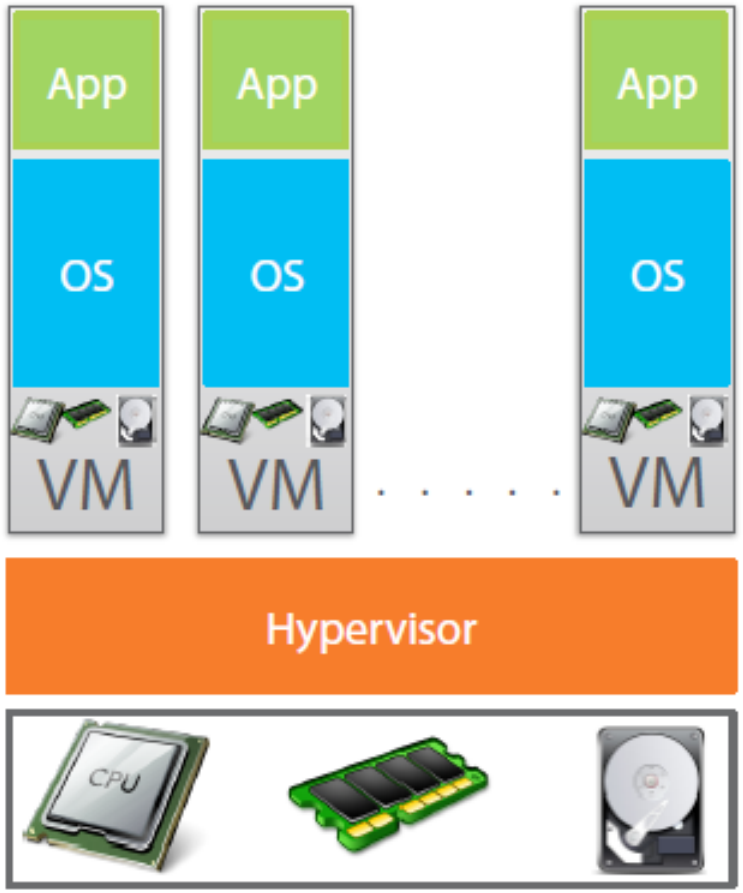


Physical Machine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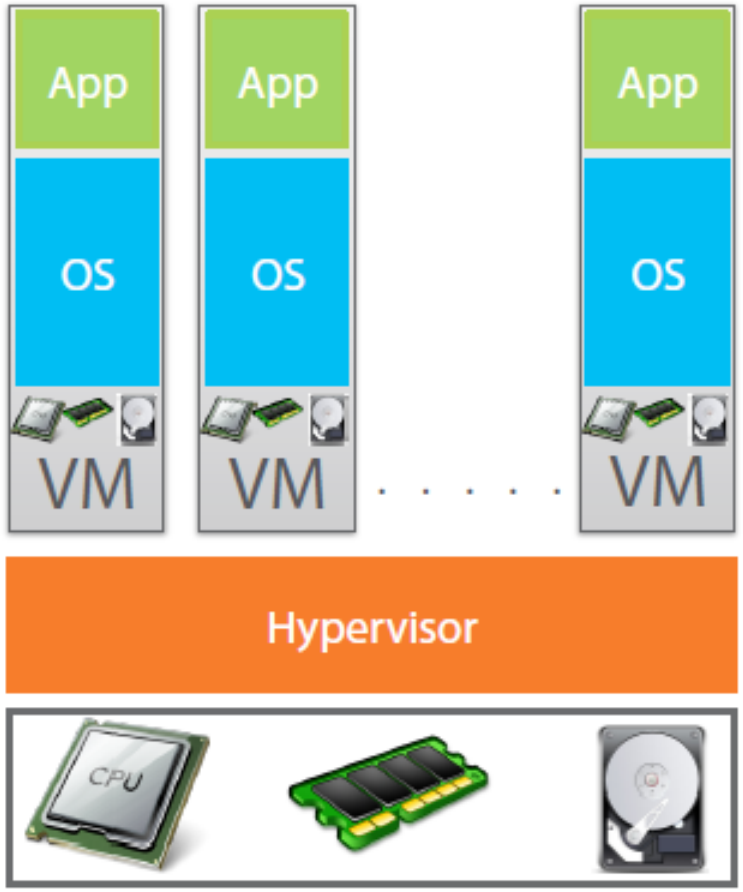
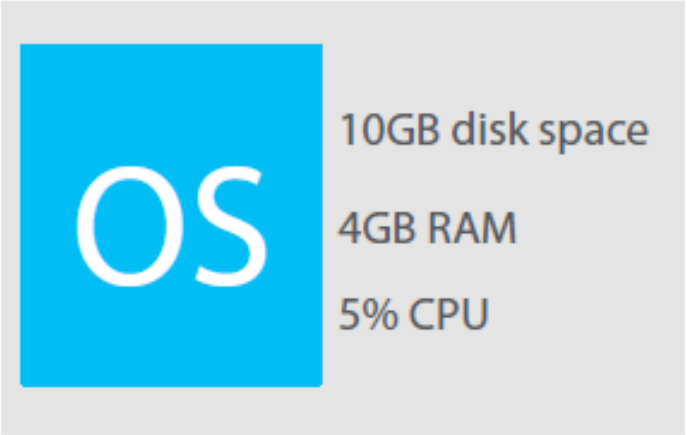


Physical Machine

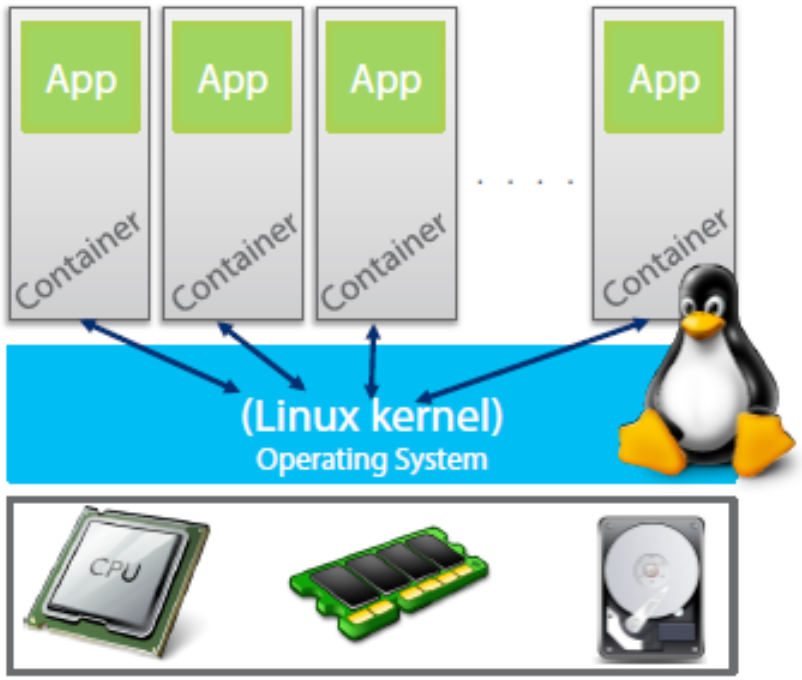


x 10 =

100GB disk space

40GB RAM

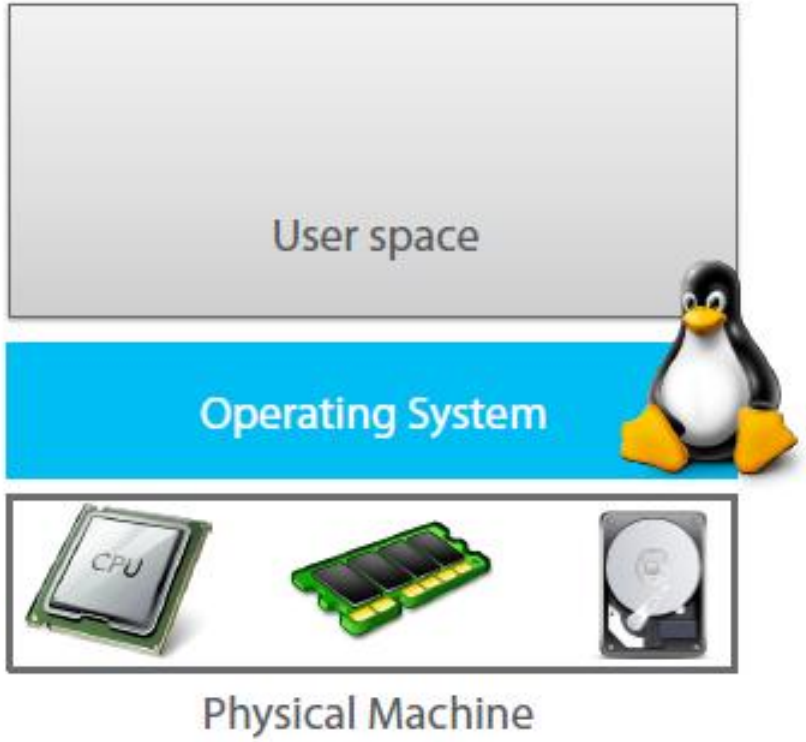
50% CPU



Physical Machine

Containers consume less CPU, RAM and disk resource than Virtual Machines

How Containers Work



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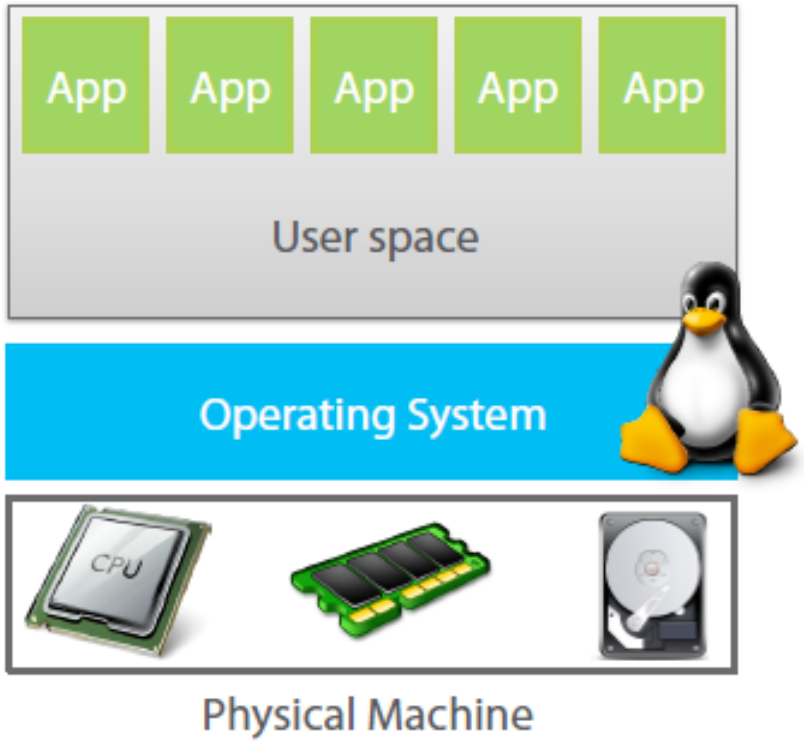

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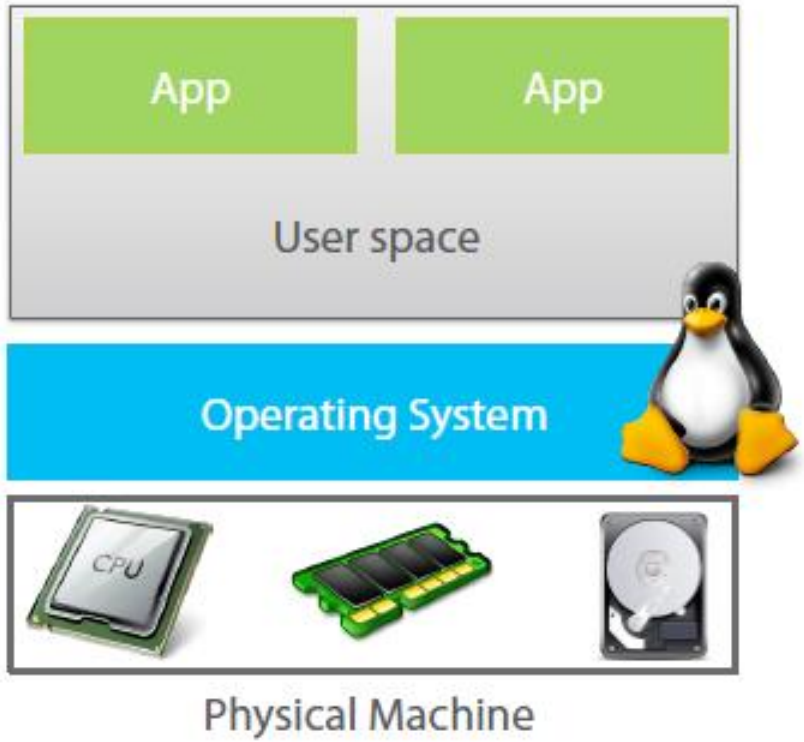

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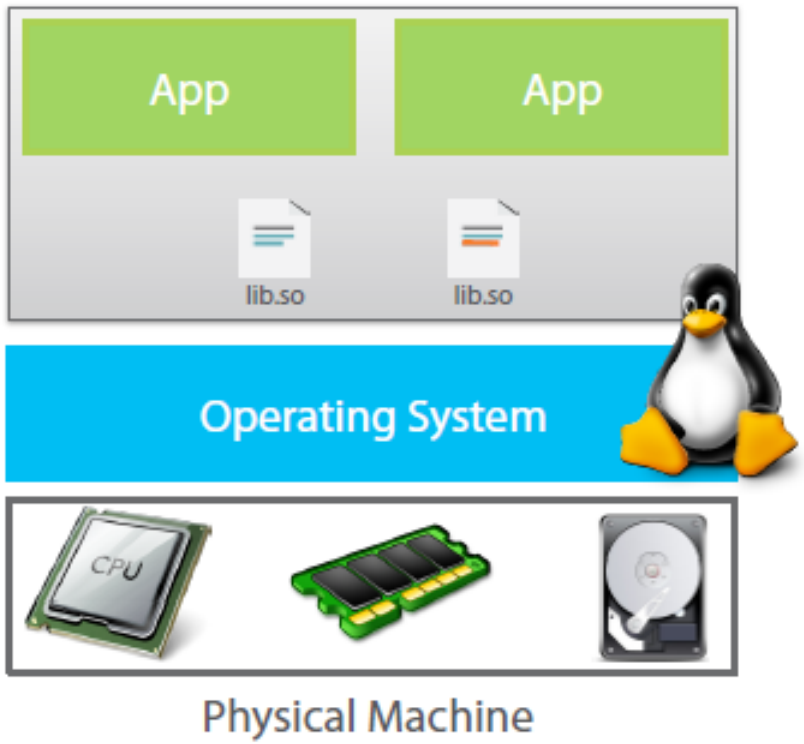

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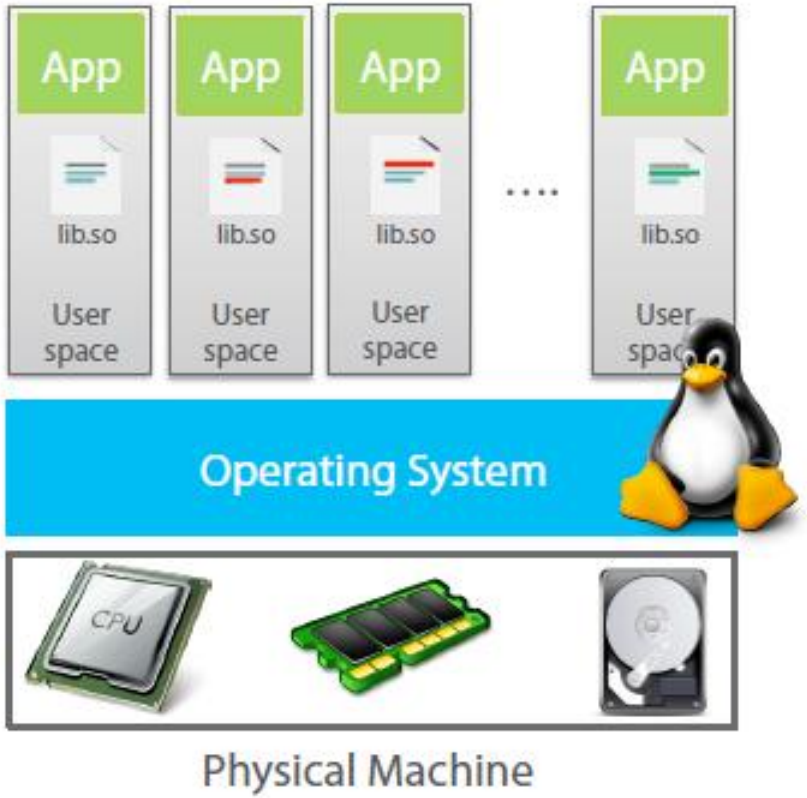

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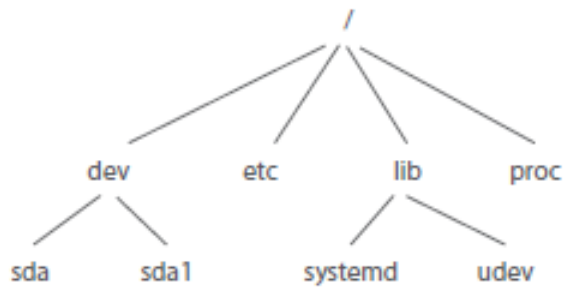

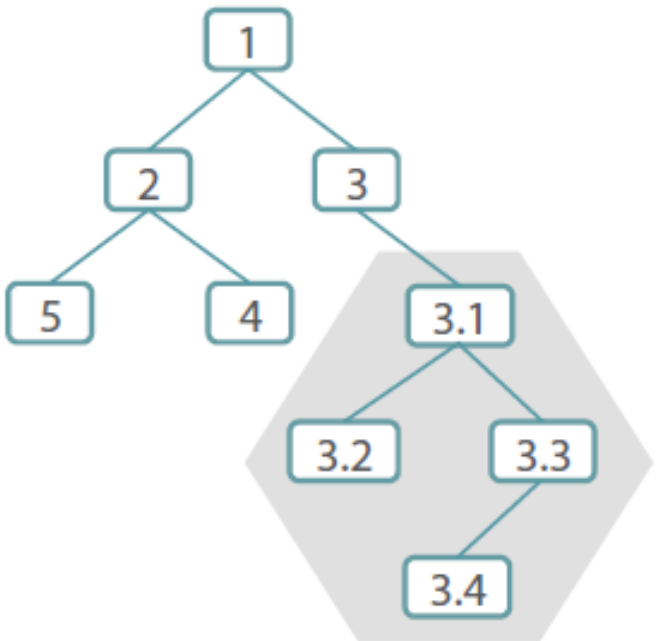

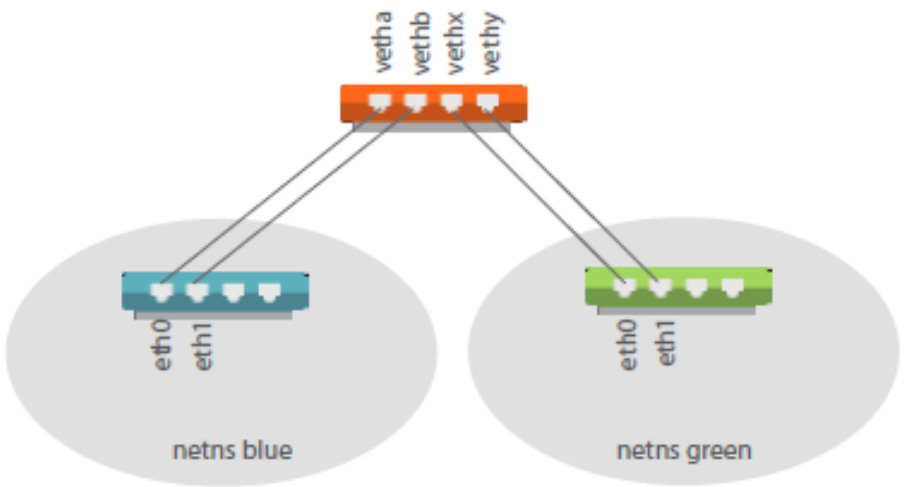

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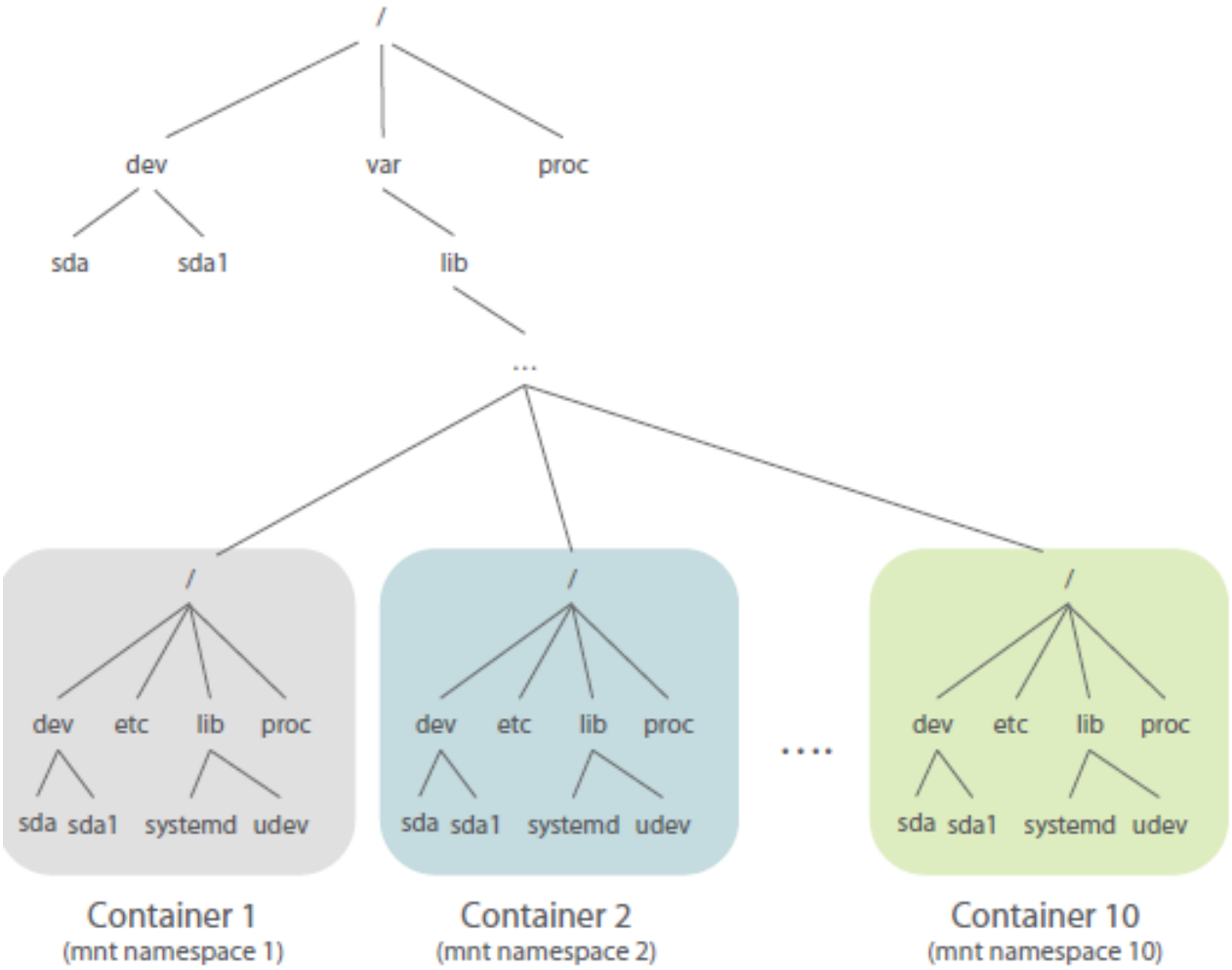

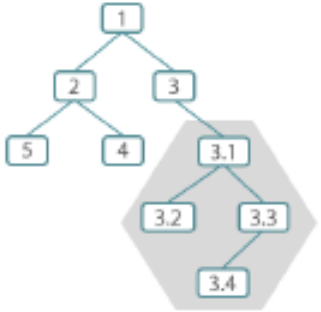

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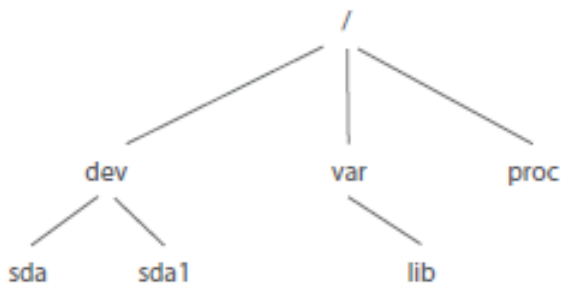
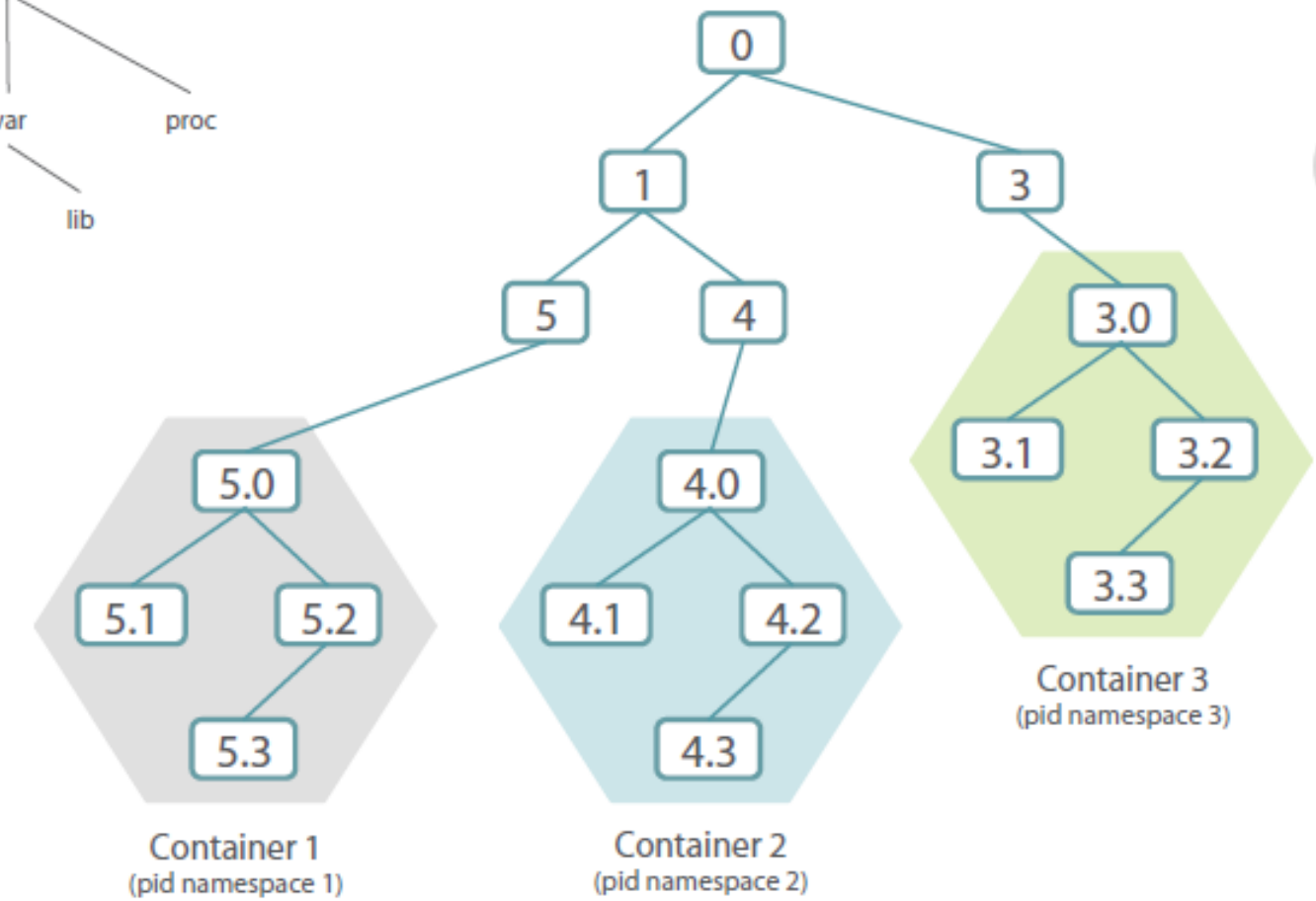




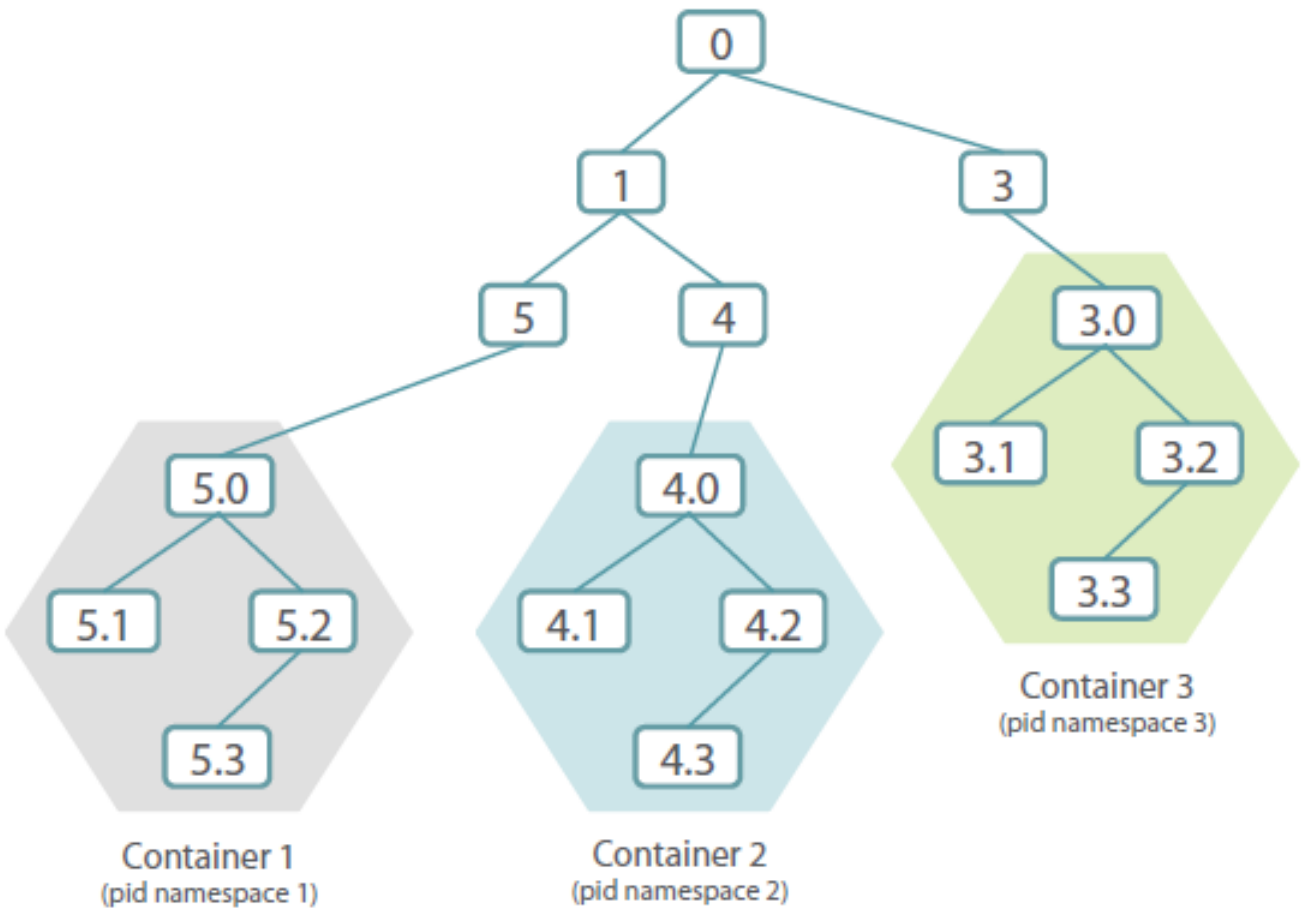
Kernel Namespaces

The pid Namespace

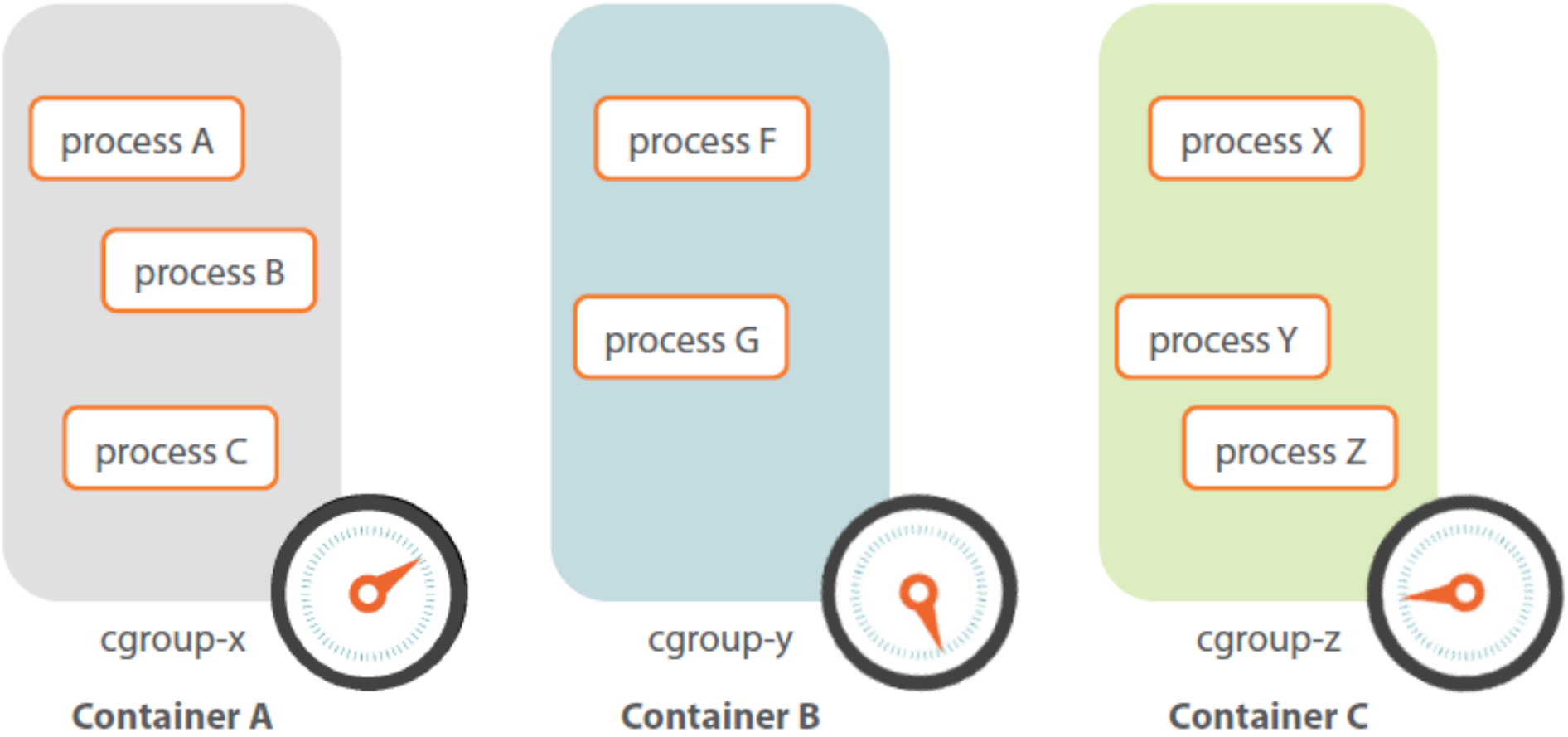
The net Namespace

The mnt Namespace

The user Namespace



Control Groups (cgroups)



Capabilities

root	non root
✓	✗

Capabilities

root

CAP_AUDIT_CONTROL ✓

CAP_CHOWN ✓

CAP_DAC_OVERRIDE ✓

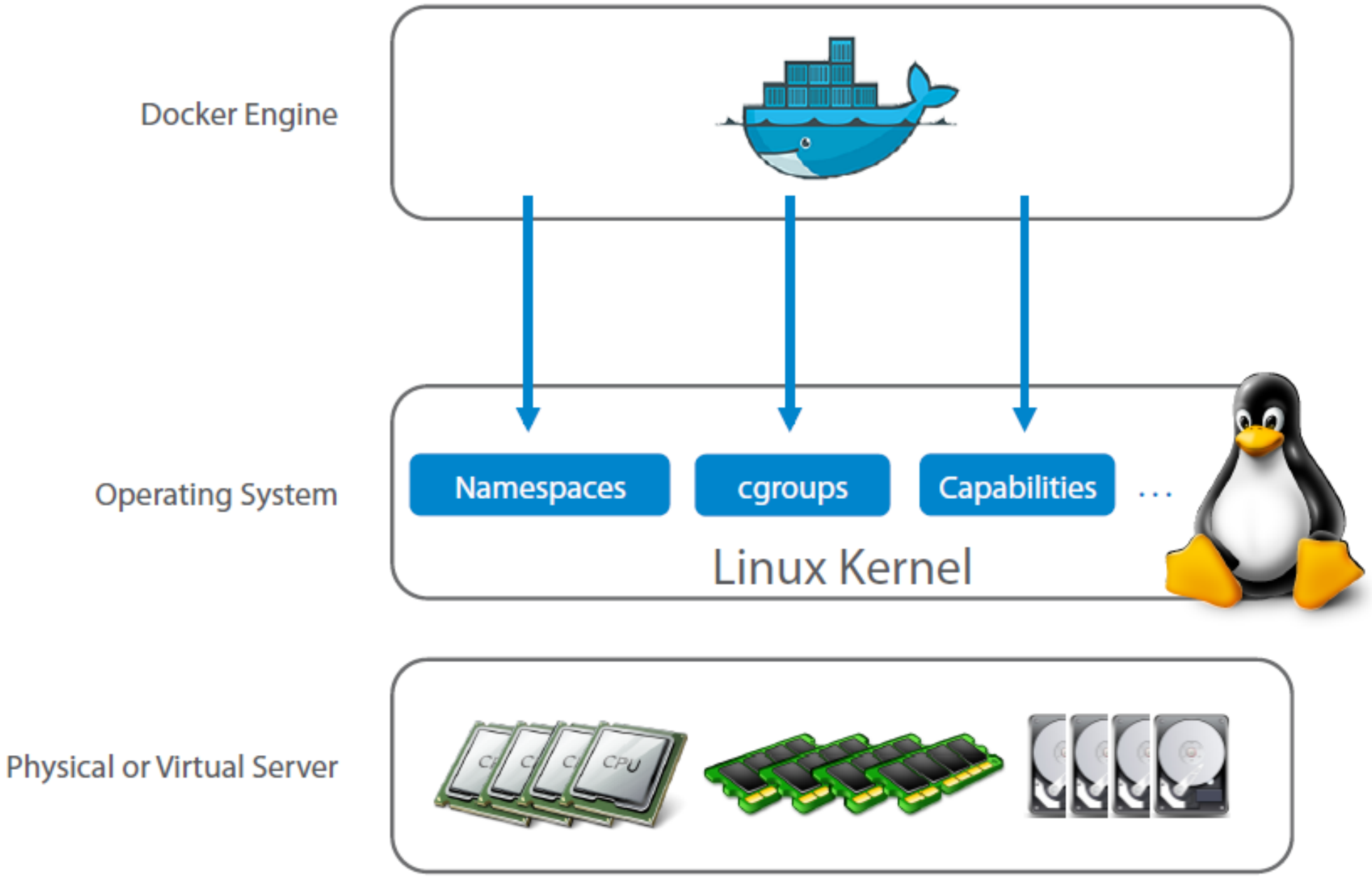
CAP_KILL ✓

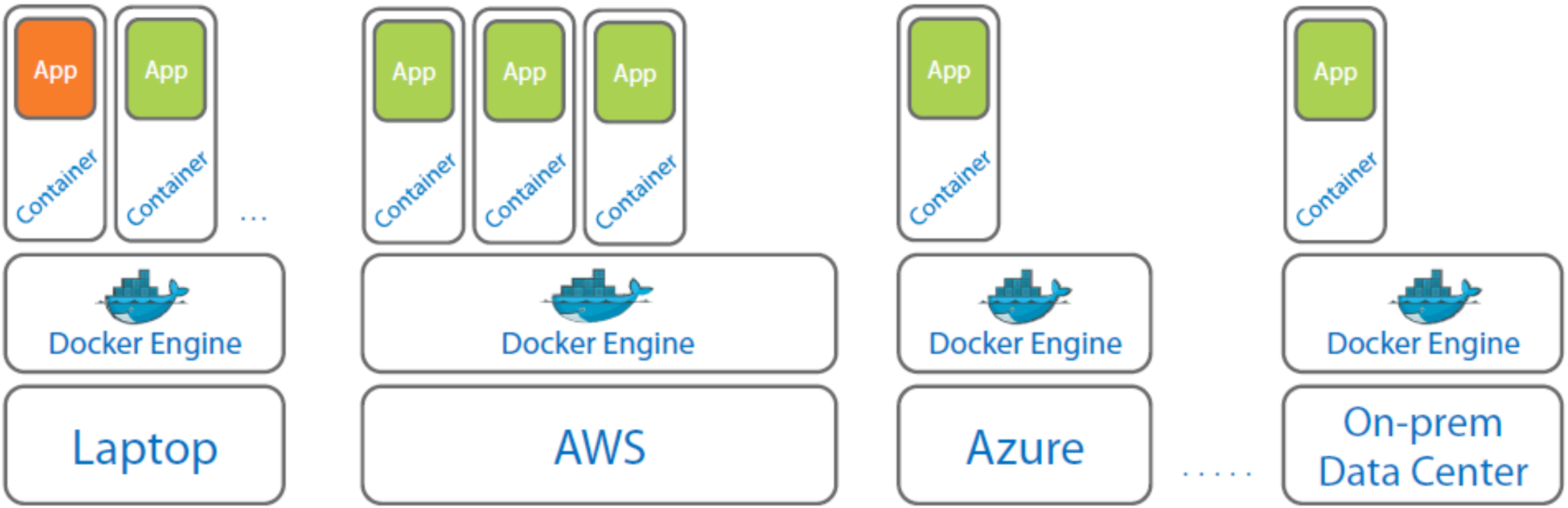
CAP_NET_BIND_SERVICE ✓

CAP_SETUID ✓

. . . . . ✓


docker


Docker Engine
Operating System
Namespaces
cgroups
Capabilities
...
Linux Kernel
Physical or Virtual Server
CPU


App
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Container
Container
...
Docker Engine
Laptop
App
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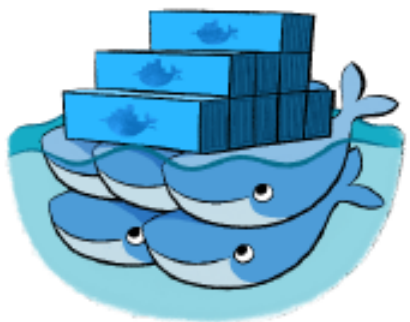
Container
Container
Container
Docker Engine
AWS
App
Container
Docker Engine
Azure
.....
App
Container
Docker Engine
On-prem
Data Center

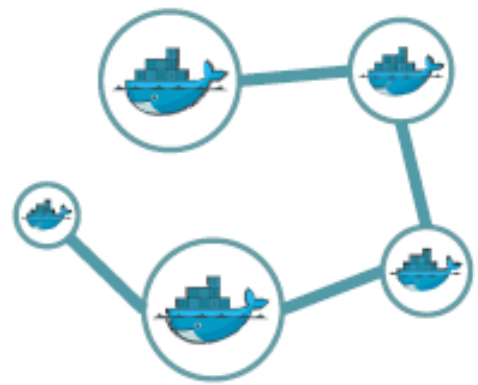
The Evolving Docker Platform

Registry
(Docker Hub)

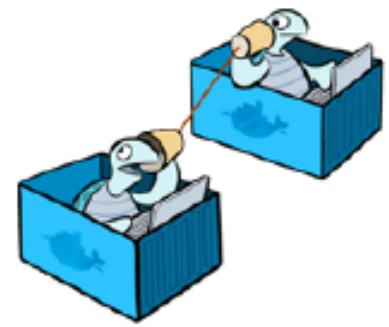
Clustering
(Docker Swarm…)



Orchestration
(Docker Compose…)



Networking
(libchan…)



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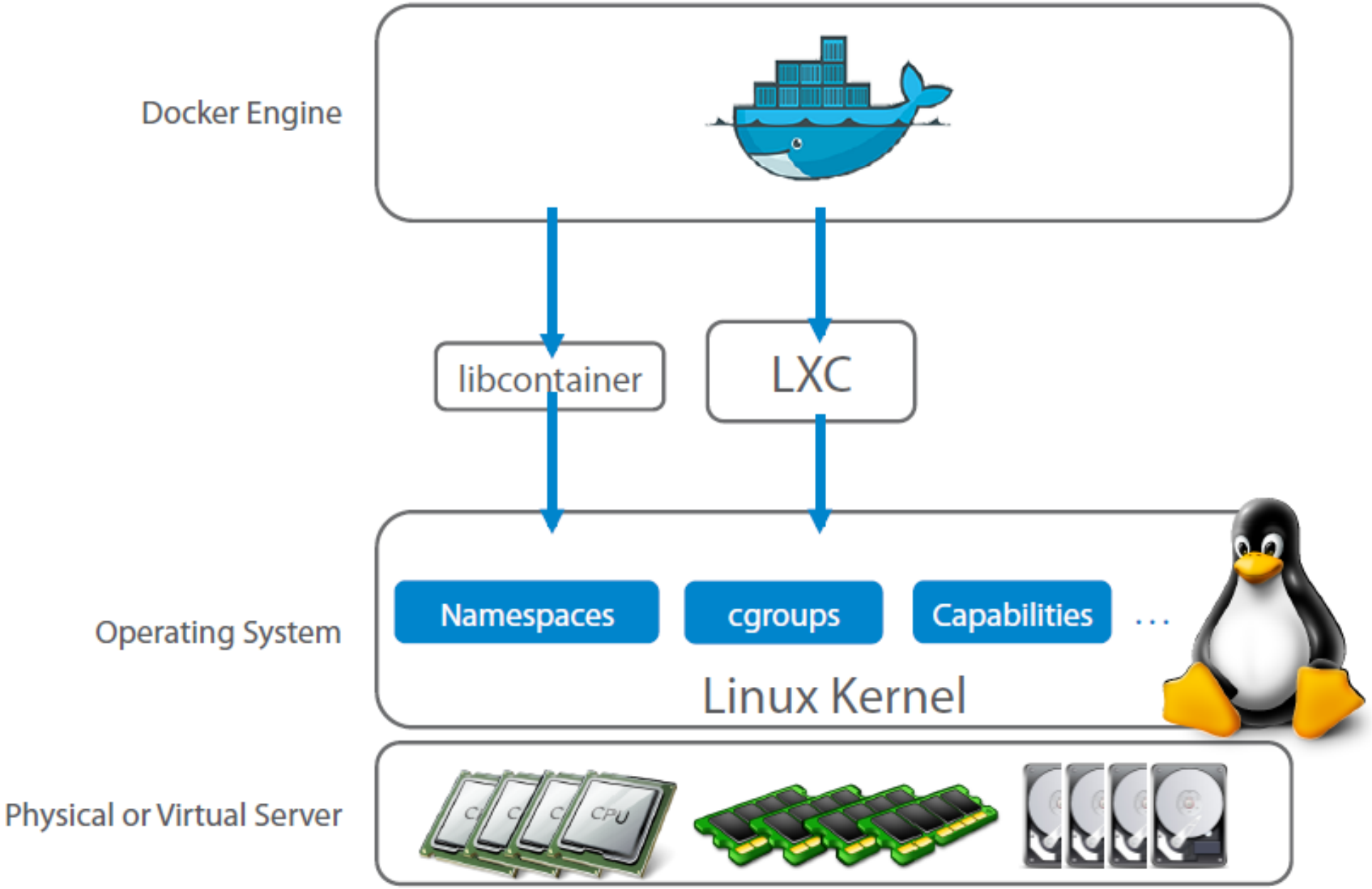
Solomon Hykes

LXC and Docker…… What's the skinny?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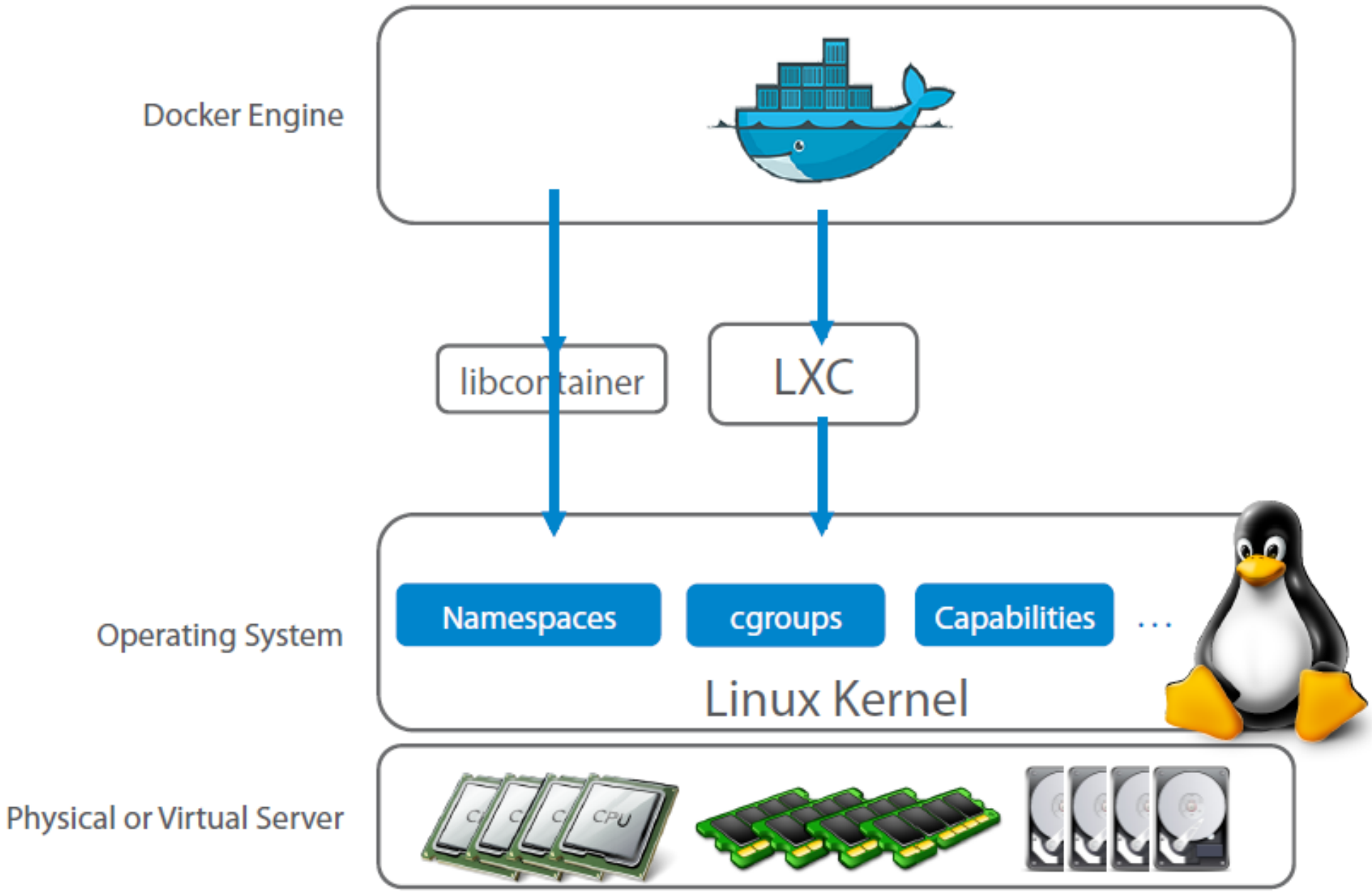
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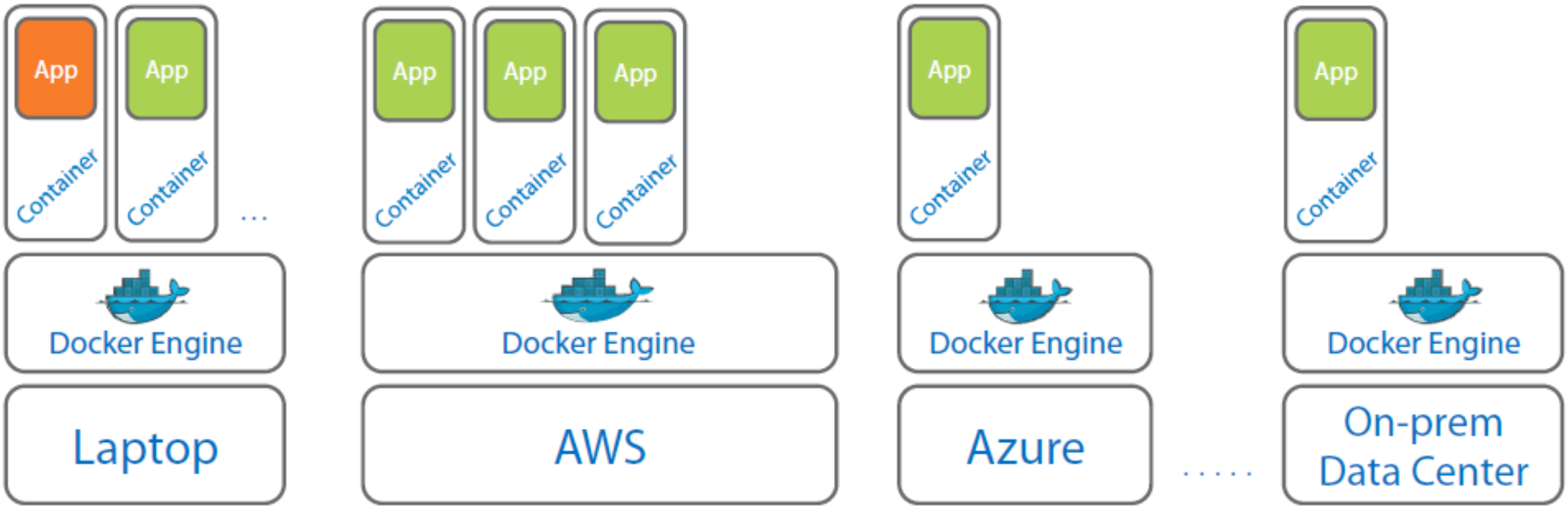
The Future of Docker


App
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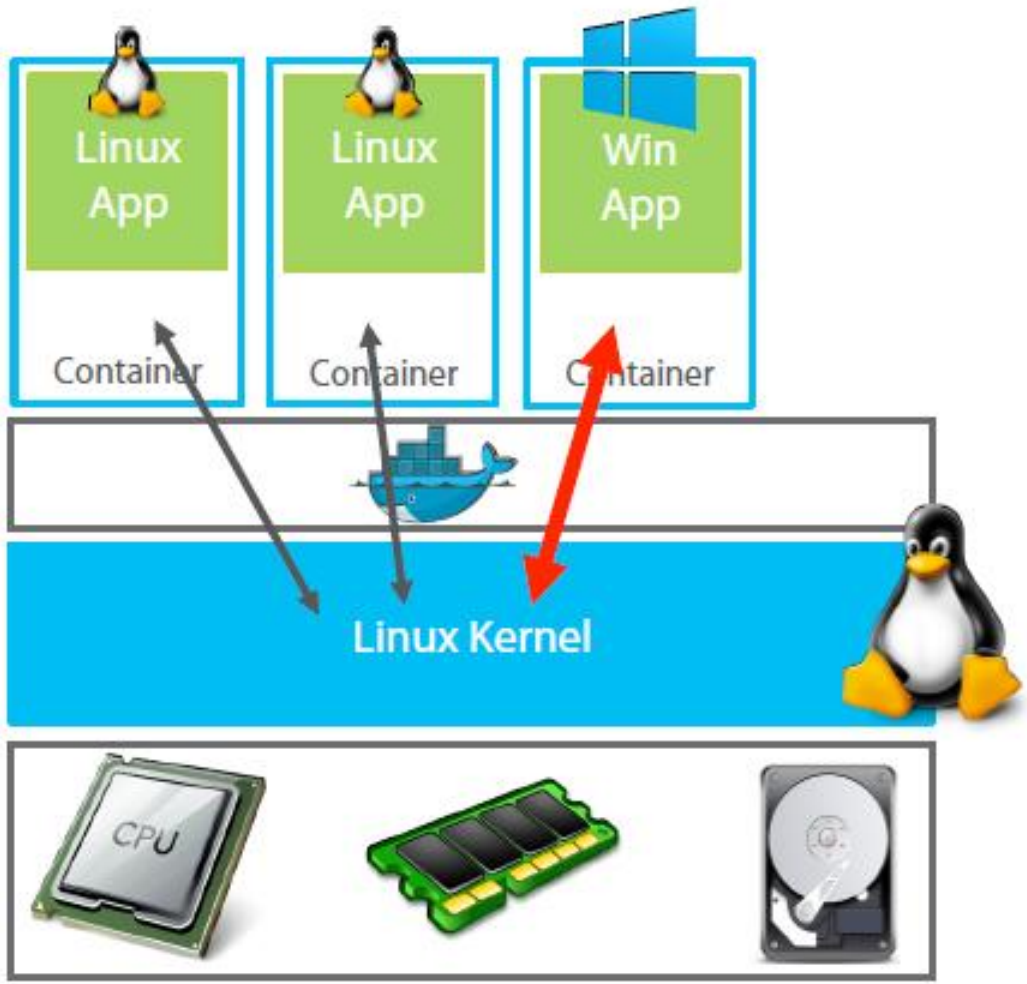
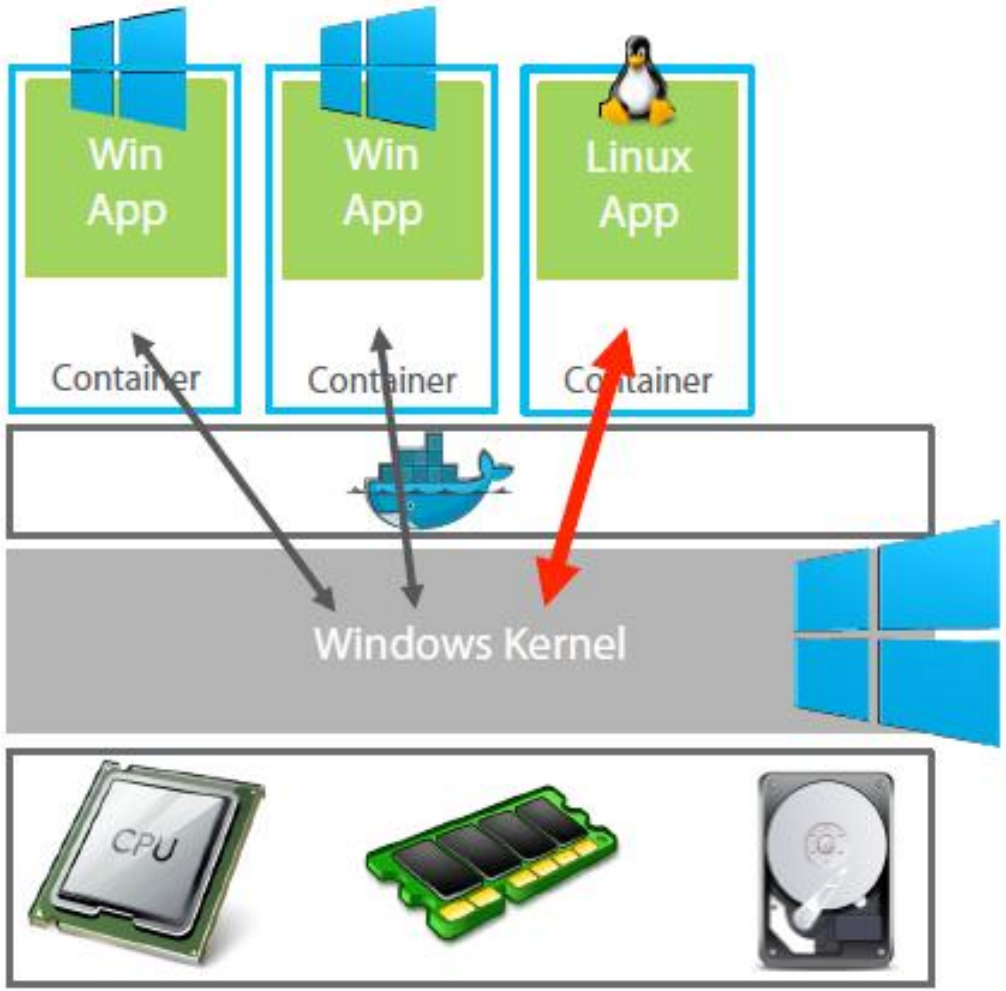
Docker Engine
Docker Engine
Docker Engine
Docker Engine
Laptop
AWS
Azure
.....
On-prem
Data Center



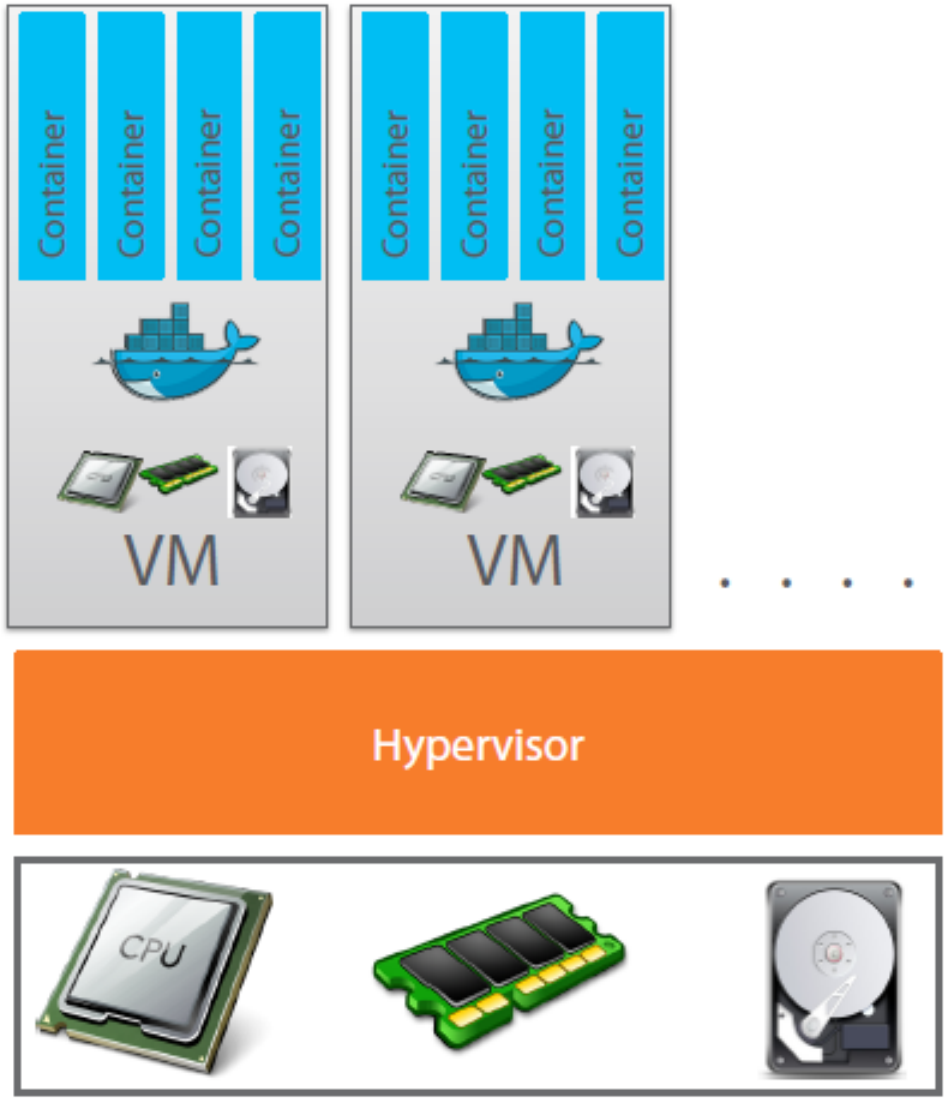
Physical Machine



Physical Machine

Containers are not for virtualization, and they **are using the resources of the host machine**. As a result, for now windows container cannot run "as-is" on linux machine.

But - you can do it by using VM - as it works on windows. You can install windows VM on your linux host, which will allow to run windows containers.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Hypervisor
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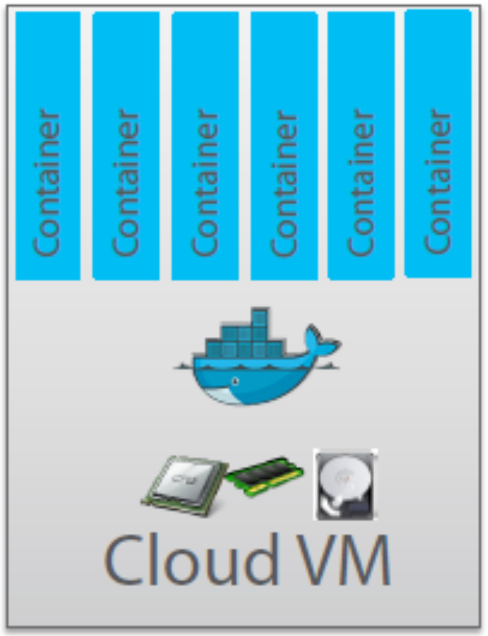
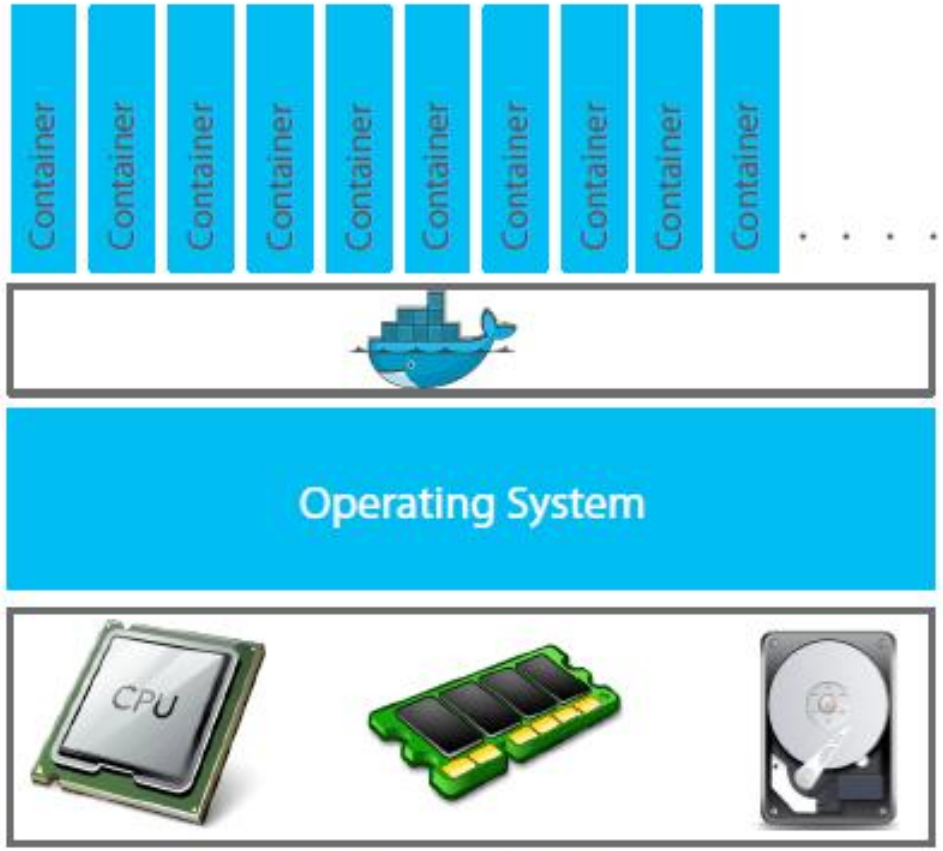
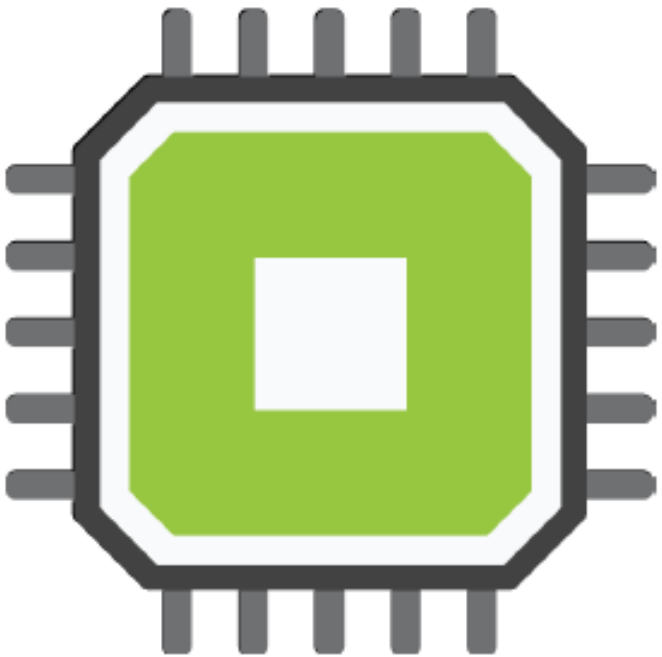

Container
Container
Container
Container
Container
Container
Cloud VM



Physical Machine



Chip-level assists for Containers

- Performance offloads
- Security features
- ……