ThoughtWorks®

CONTAINERS
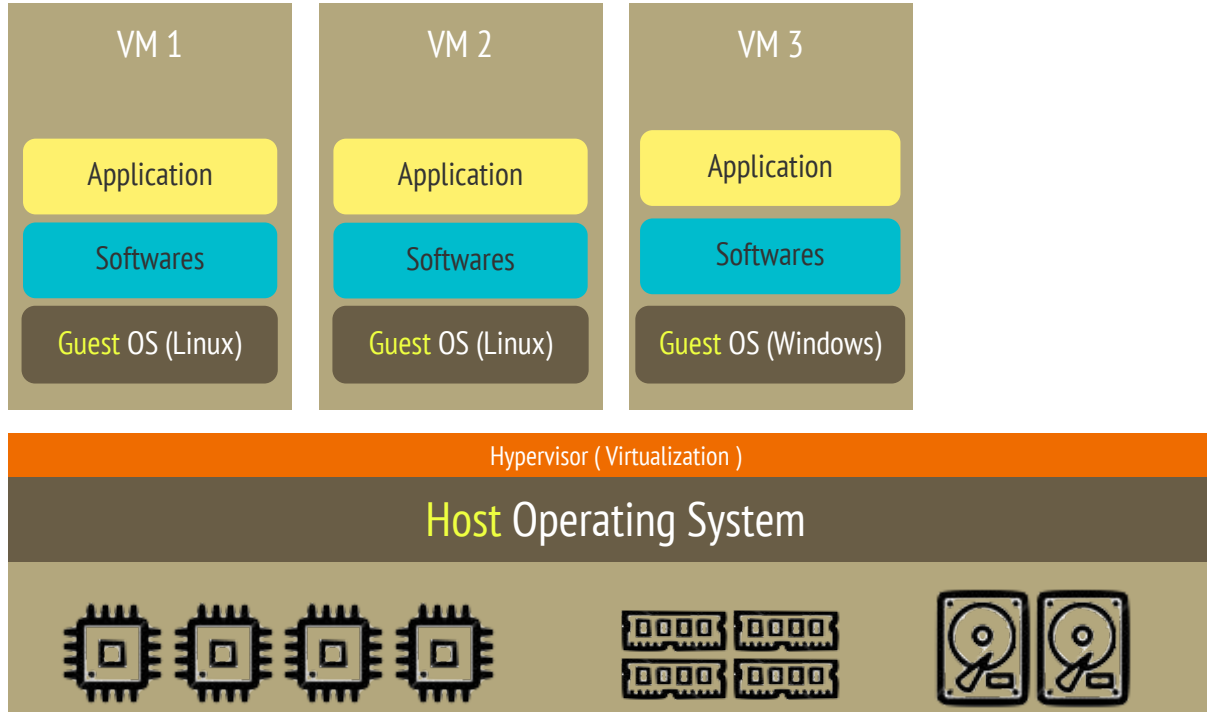
Rise of the Containers Workshop

Infrastructure as a Service

IaaS is on-demand provisioning of building blocks such as computing power (CPU and RAM), storage, networking. This is lowest level (raw form) of service in cloud.

VM based IaaS model

VM 1	VM 2	VM 3
Application	Application	Application
Softwares	Softwares	Softwares
Guest OS (Linux)	Guest OS (Linux)	Guest OS (Windows)

Hypervisor (Virtualization)

Host Operating System

Steps to setup an Environment

1. Provision VM with Guest OS
   - Create user, setup profile, set ulimit, …

2. Install required Software
   - JDK, Tomcat, Nginx …
   - Create required database users …

3. Deploy Application
   - Configure application properties

Challenges with Virtual Machine model?

RESOURCE UTILIZATION

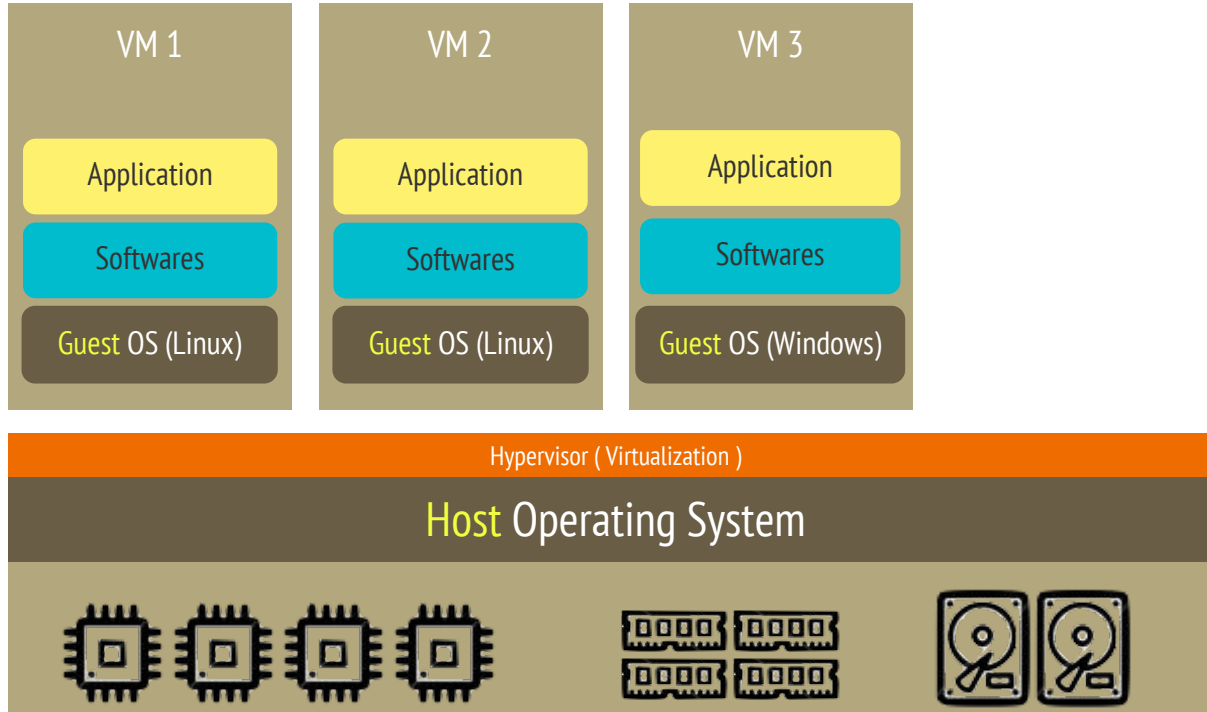CPU, RAM, Disk consumed by Guest OS

PERFORMANCE OVERHEAD

Multiple OS + hypervisor translation layer

COST OVERHEAD

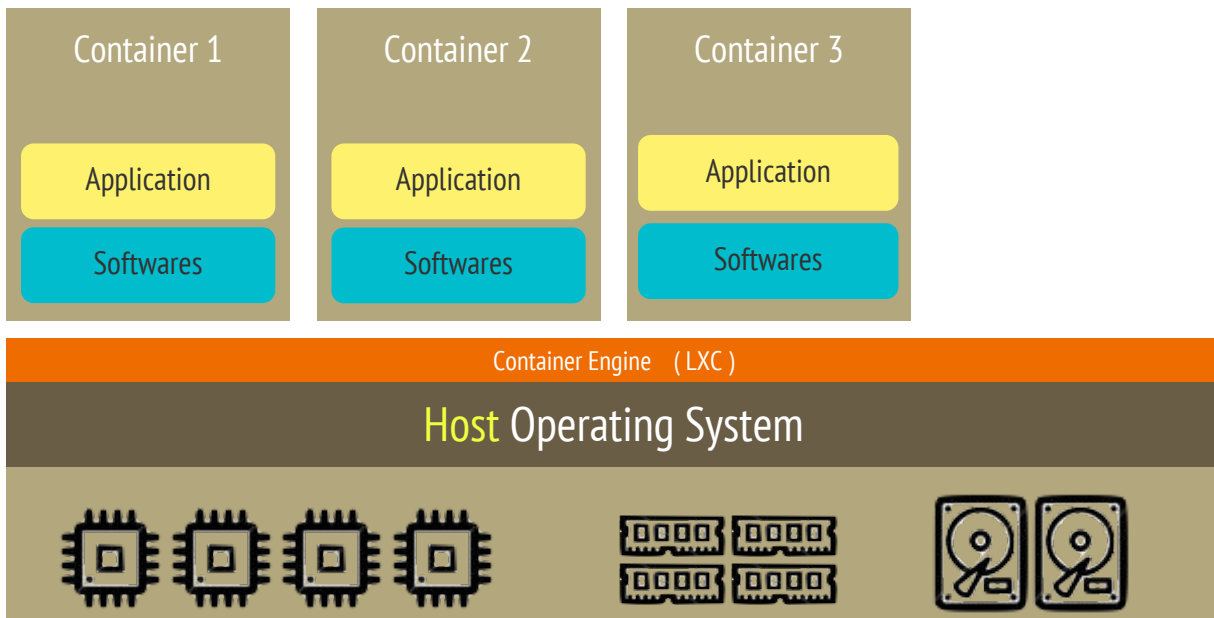Software licenses (Guest OS) (capex)

Each VM Maintenance & Upgrade/Patching cost (opex)

VM to Container model

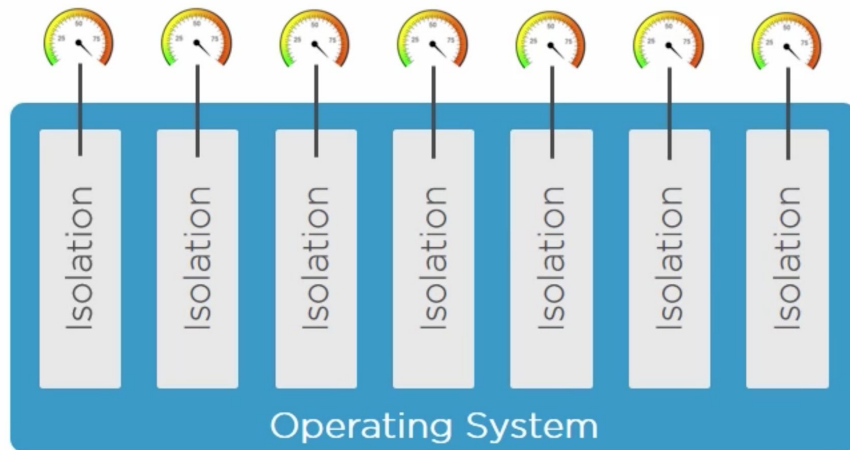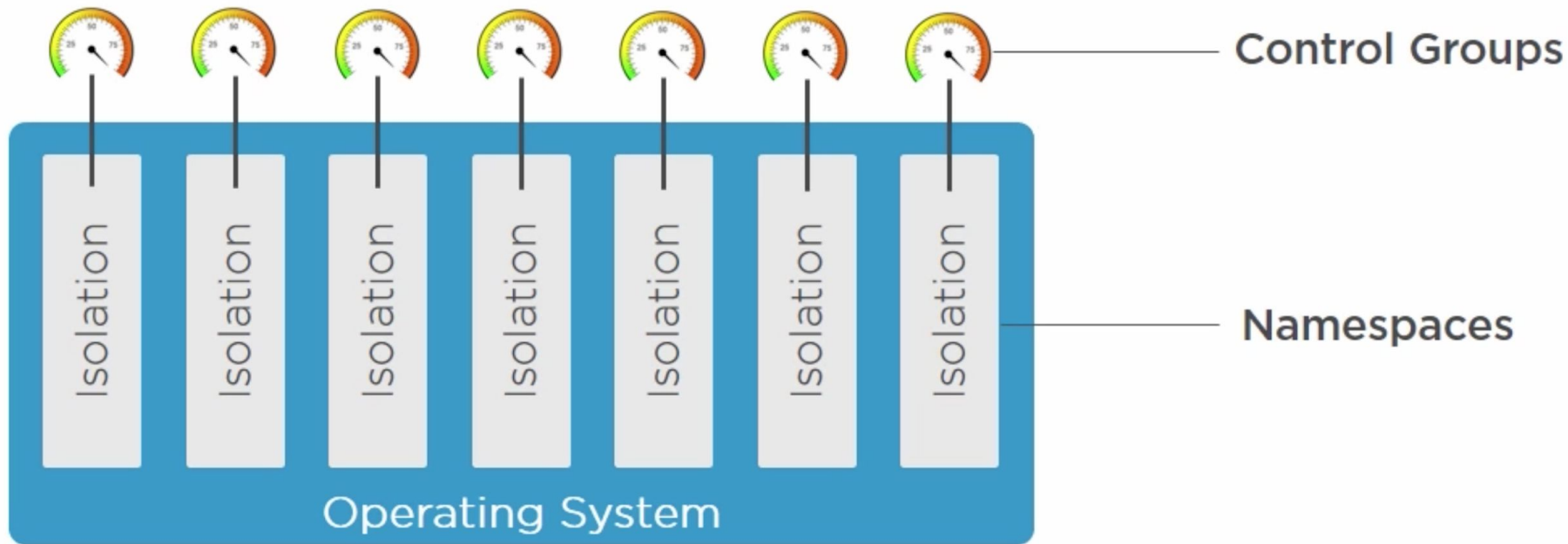| VM 1	VM 2	VM 3
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Hypervisor (Virtualization)

Host Operating System

Container model

Container 1	Container 2	Container 3
Application	Application	Application
Softwares	Softwares	Softwares

Container Engine   (LXC)

Host Operating System

Container

container

/kənˈteɪnə/

noun: Isolated area of an OS with resource usage limits applied

Isolation Isolation Isolation Isolation Isolation Isolation Isolation

Operating System
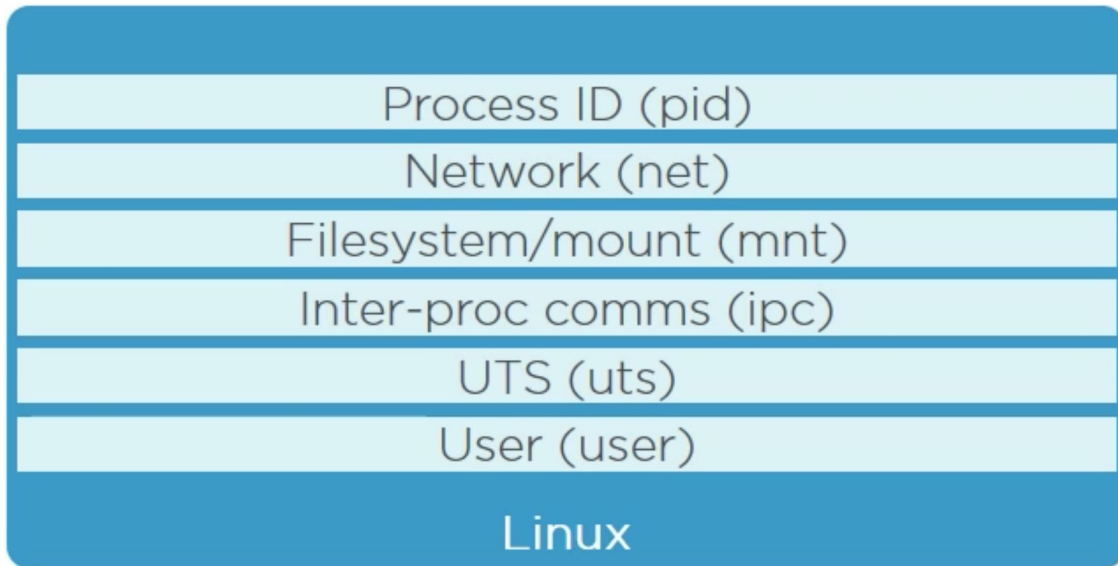
Cgroups & Namespaces

Cgroups & Namespaces

CGROUPS

allows limitation and prioritization of resources (CPU, memory, block I/O, network, etc.)
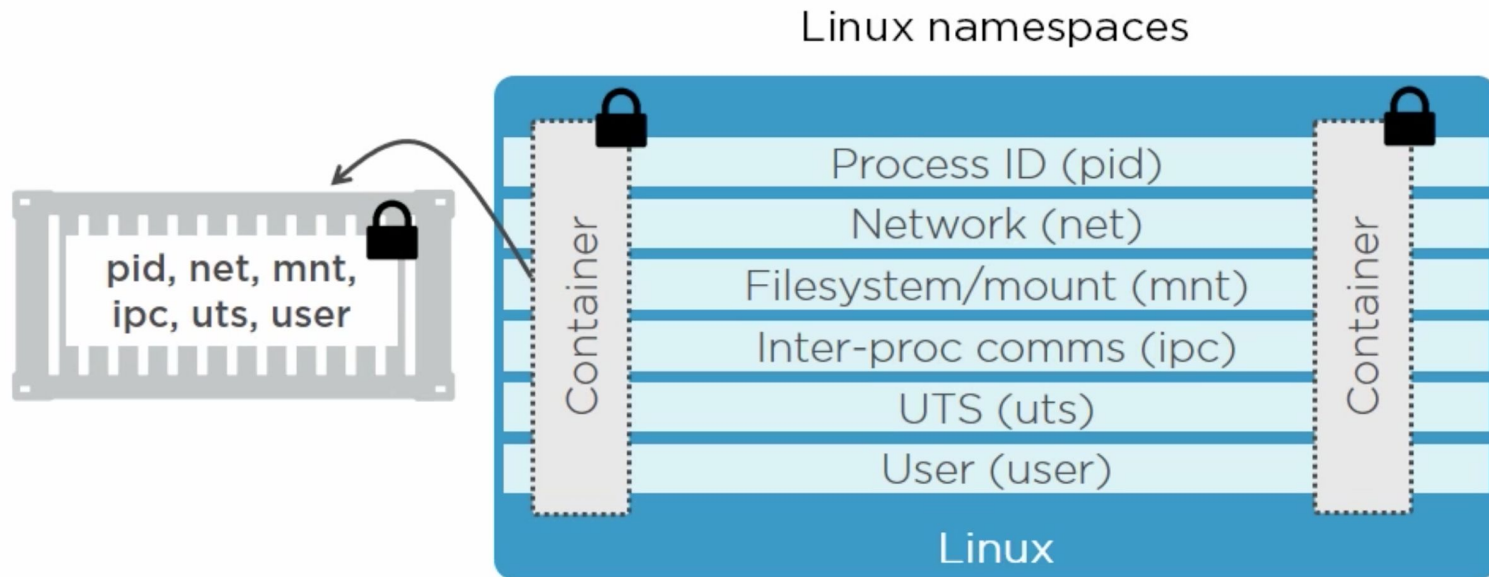
NAMESPACE ISOLATION

allows complete isolation of an applications' view of the operating environment, including process trees, networking, user IDs and mounted file systems
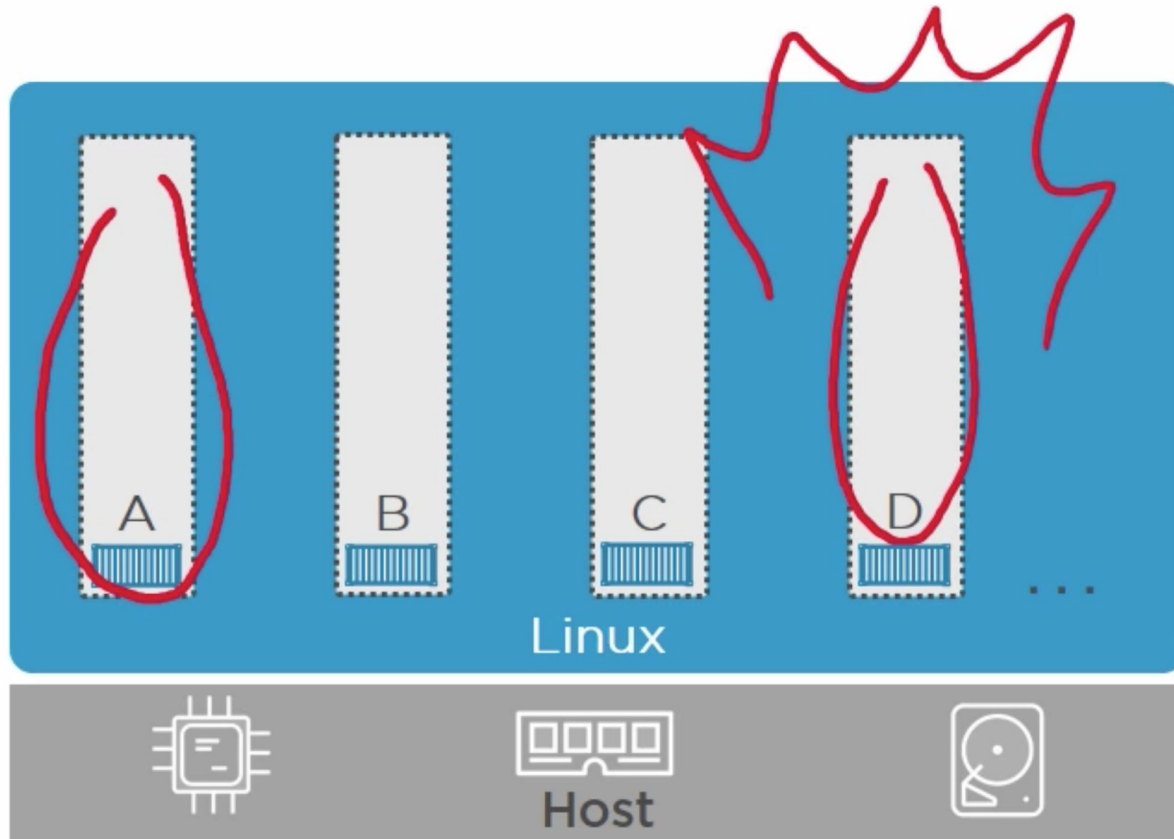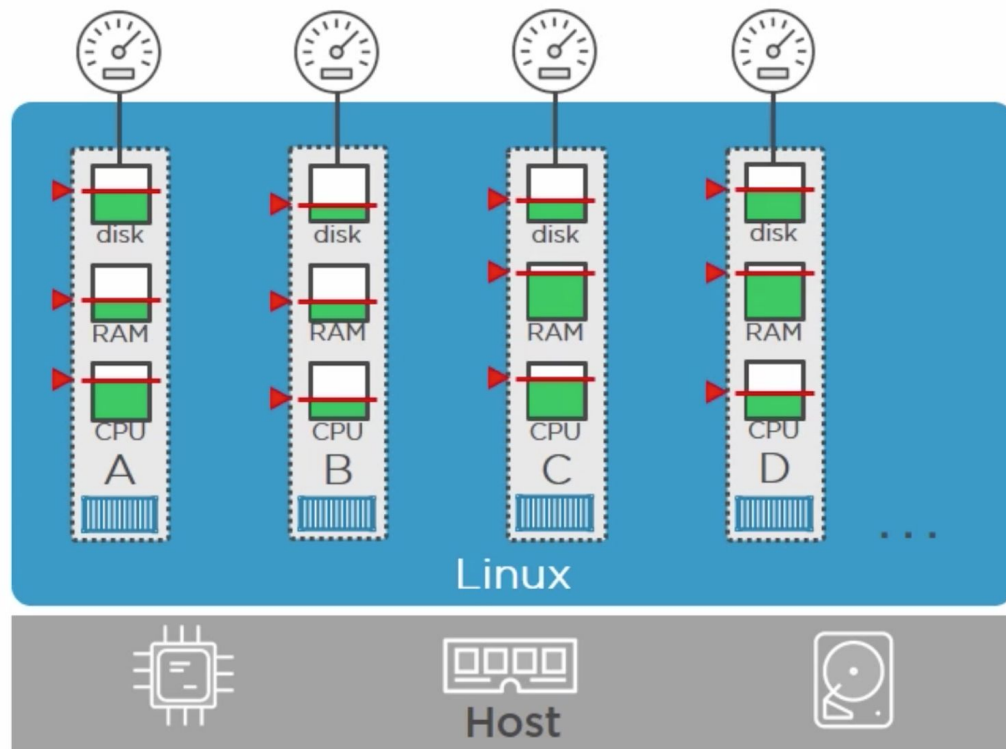
Namespaces

Linux namespaces

Process ID (pid)
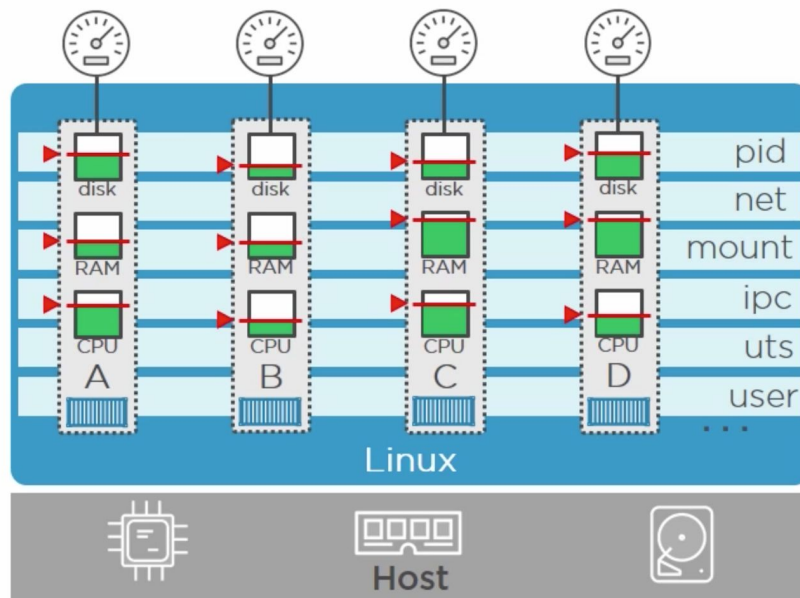
Network (net)

Filesystem/mount (mnt)

Inter-proc comms (ipc)

UTS (uts)

User (user)

Linux

Namespaces

Linux namespaces

pid, net, mnt, ipc, uts, user

Container

Process ID (pid)
Network (net)
Filesystem/mount (mnt)
Inter-proc comms (ipc)
UTS (uts)
User (user)

Container

Linux

Are Namespaces Just sufficient ?

Control Groups

The Complete Picture
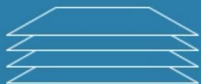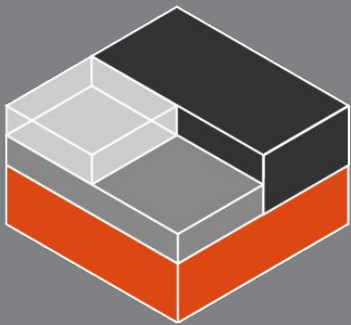
LXC (Linux containers)

LXC (Linux Containers) is an OS level virtualization method for running multiple isolated Linux systems (containers) on a control host using a single Linux kernel.
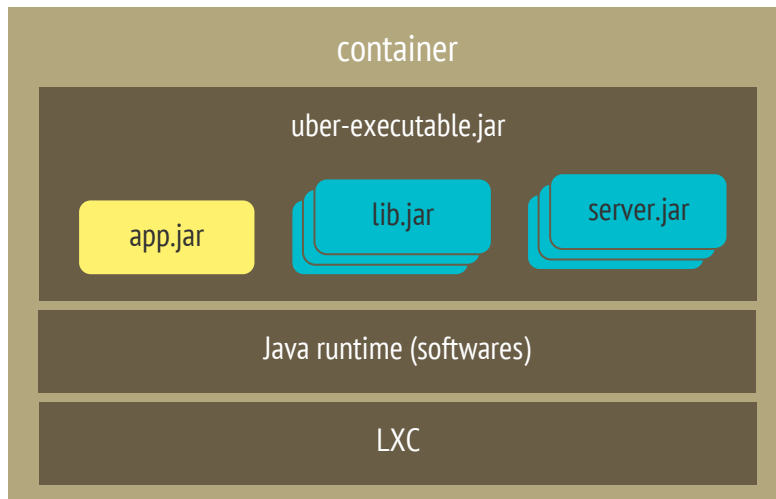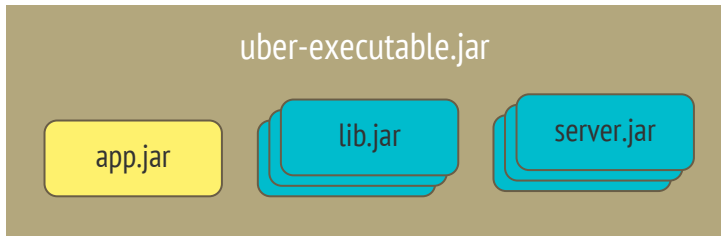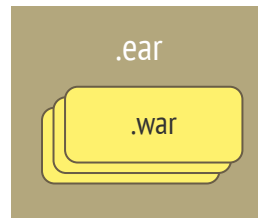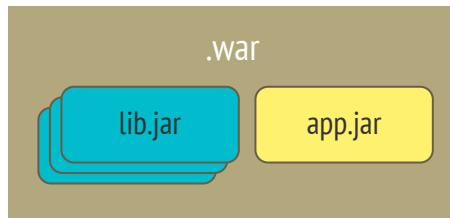
Container Characteristics

- Each container runs in an sandboxed env using namespace isolation

- Container lifecycle is defined by main process (tightly coupled)

- Boot time is main process start time (OS boot time is reduced)

- Container can have multiple process other than main process

Container packaging

.class

app.jar
.class

.war
lib.jar   app.jar

.ear
.war

uber-executable.jar
app.jar   lib.jar   server.jar

container
uber-executable.jar
app.jar   lib.jar   server.jar

Java runtime (softwares)

LXC
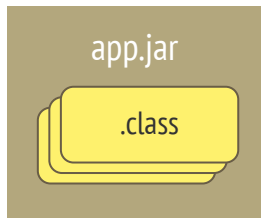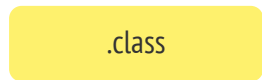
THANK YOU

For questions or suggestions:

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Offerings of Cloud services

- Infrastructure as a Service (IaaS)
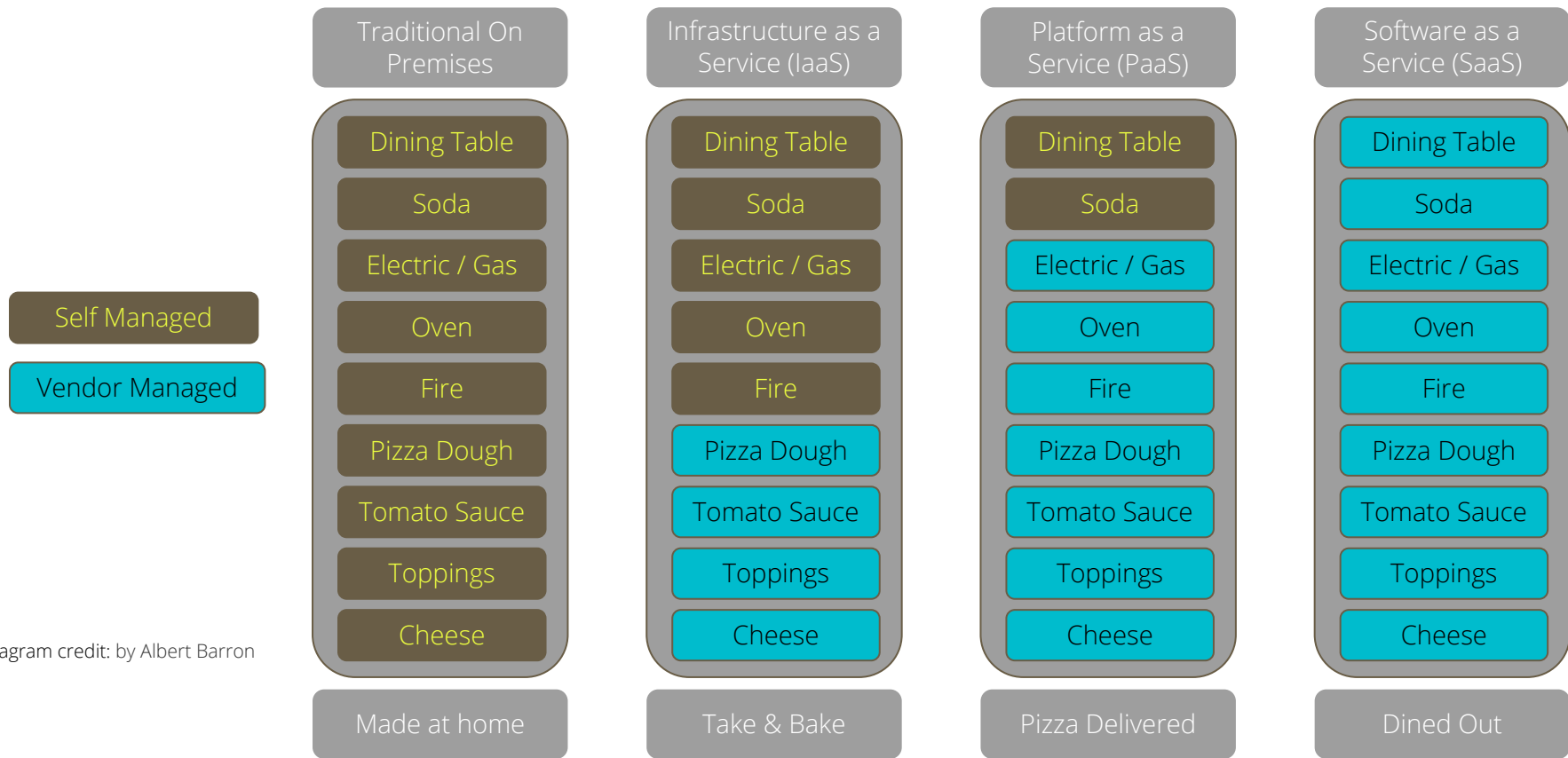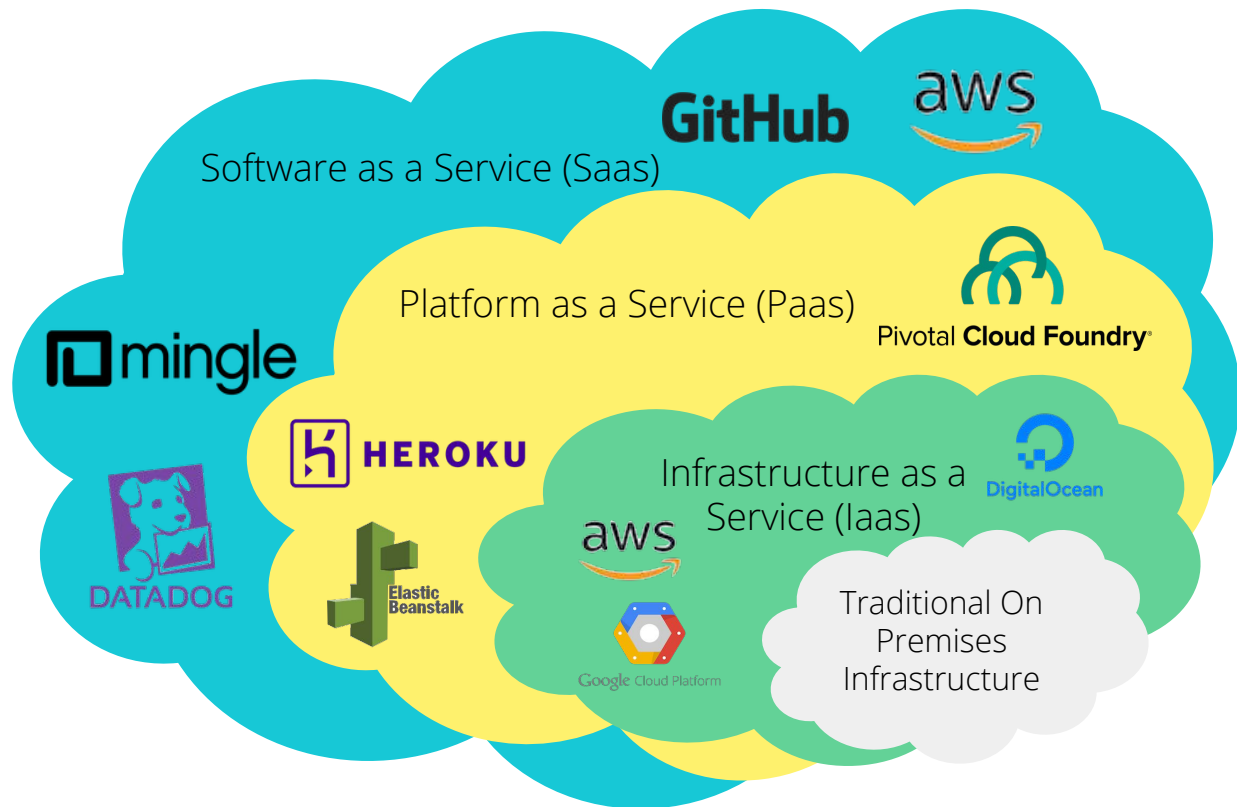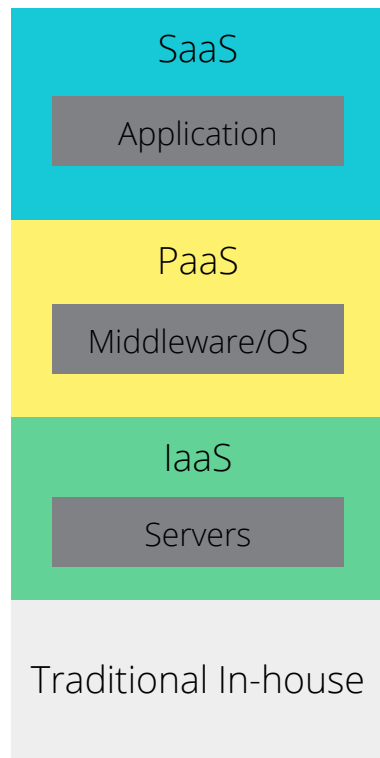
- Platform as a Service (PaaS)

- Software as a Service (SaaS)

Cloud service model with Pizza analogy

Traditional On Premises	Infrastructure as a Service (IaaS)	Platform as a Service (PaaS)	Software as a Service (SaaS)
Dining Table	Dining Table	Dining Table	Dining Table
Soda	Soda	Soda	Soda
Electric / Gas	Electric / Gas	Electric / Gas	Electric / Gas
Oven	Oven	Oven	Oven
Fire	Fire	Fire	Fire
Pizza Dough	Pizza Dough	Pizza Dough	Pizza Dough
Tomato Sauce	Tomato Sauce	Tomato Sauce	Tomato Sauce
Toppings	Toppings	Toppings	Toppings
Cheese	Cheese	Cheese	Cheese
Made at home	Take & Bake	Pizza Delivered	Dined Out

Self Managed

Vendor Managed

diagram credit: by Albert Barron

Elastic Infrastructure

New offering of Cloud service

- Infrastructure as a Service (IaaS)

- **Containers as a Service (CaaS)**

- Platform as a Service (PaaS)

- Software as a Service (SaaS)

Google Container Engine

Amazon EKS