

# Introducing Container Technology



# Agendas

---

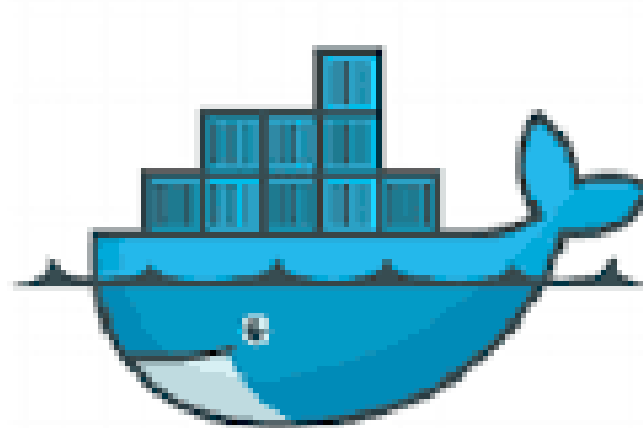
Overview of Container Technology

Overview of Container Architecture

Overview of Kubernetes and OpenShift

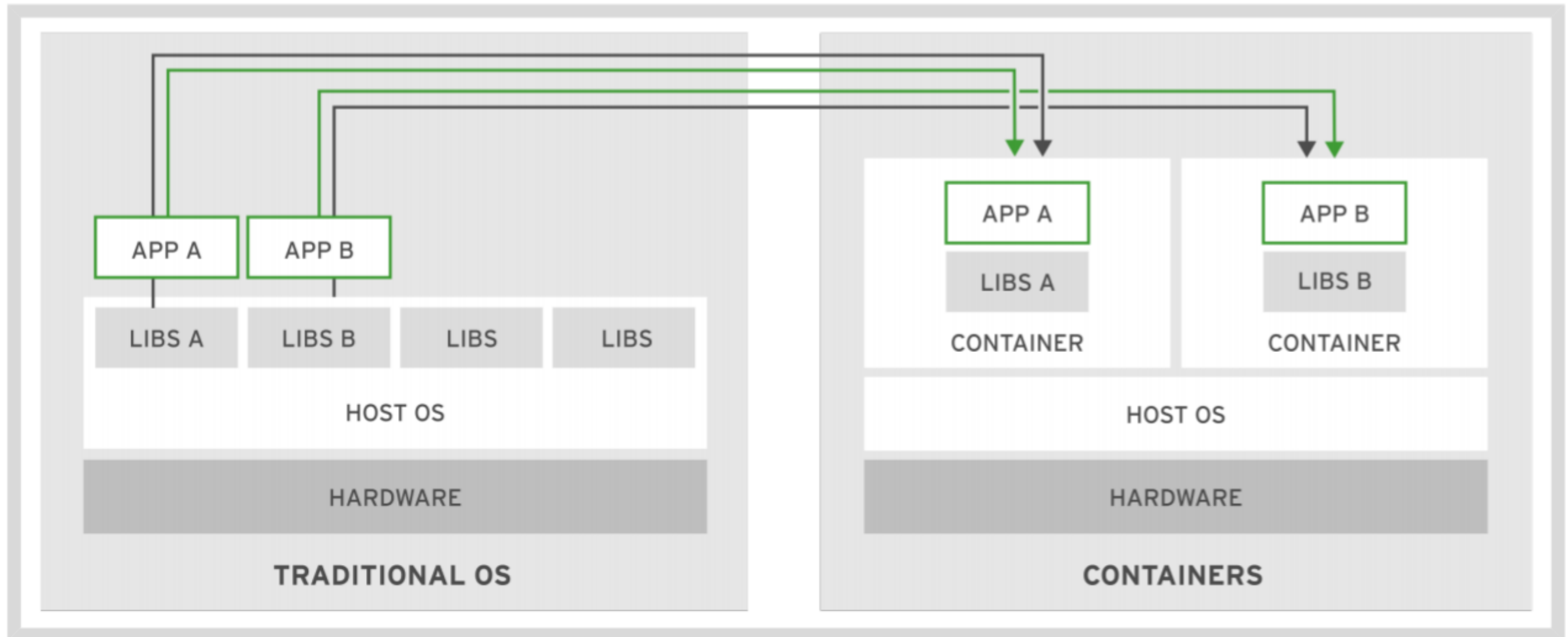
DEMO 1: Quickly starts a webserver container

DEMO 2: Quickly deploy a webserver container in OpenShift cluster



# Overview of Container Technology

# Containerized Applications



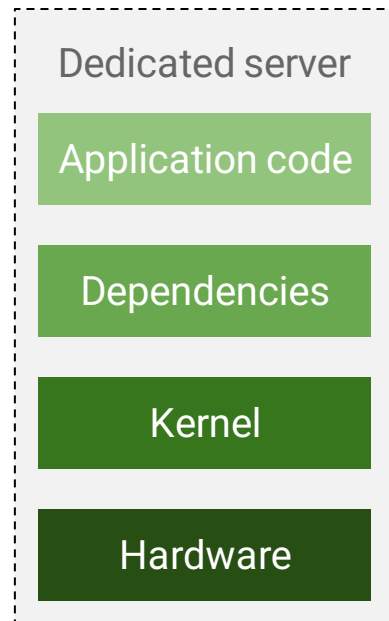
# Advantages of using containers

---

- Easier and faster to deploy
- Low hardware footprint
- Portable
- Universal format
  - Multi environment deployment
- Environment Isolation
  - Development, Testing and Production
- Reusability
- Ideal for microservices environment

# Legacy Data Center

---

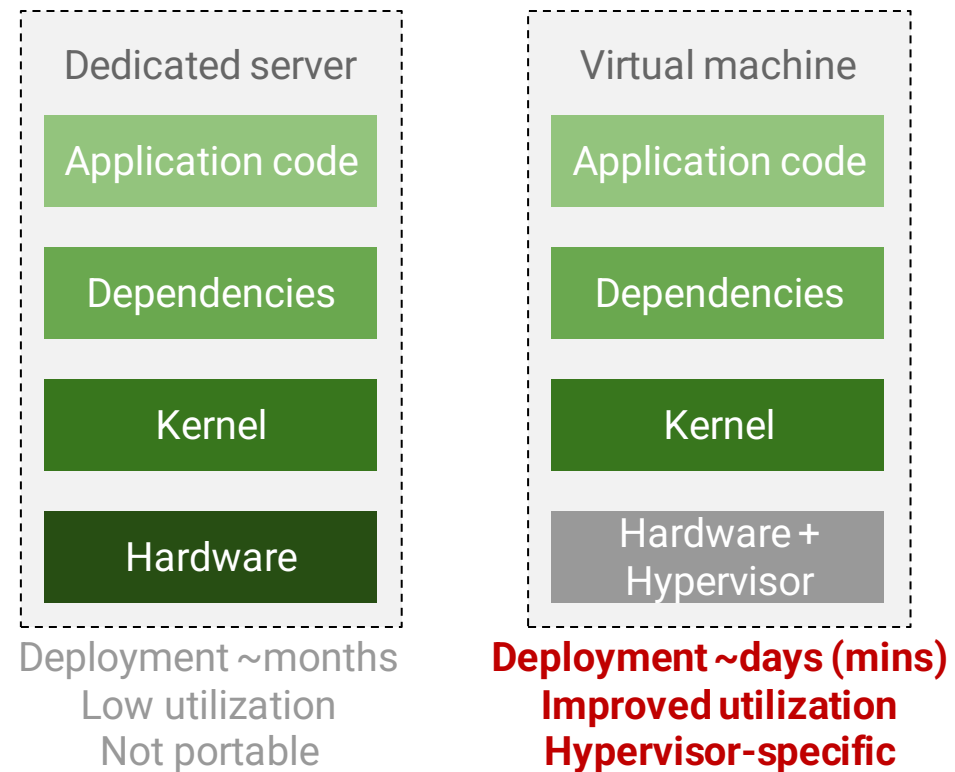


**Deployment ~months**

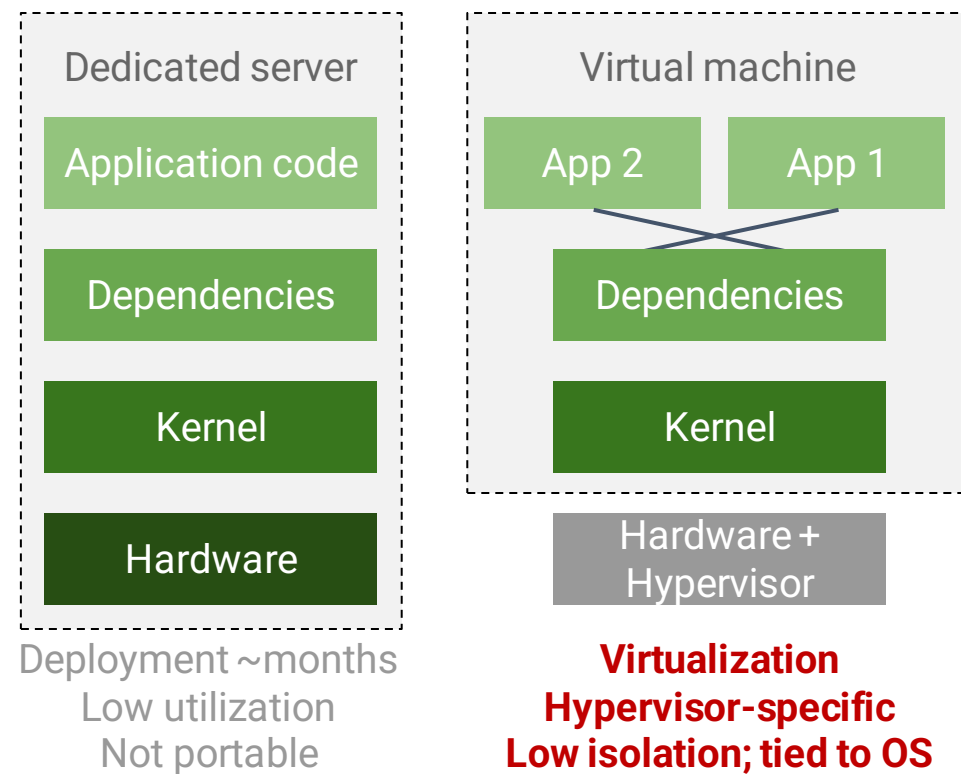
**Low utilization**

**Not portable**

# Hypervisors create and manage virtual machines

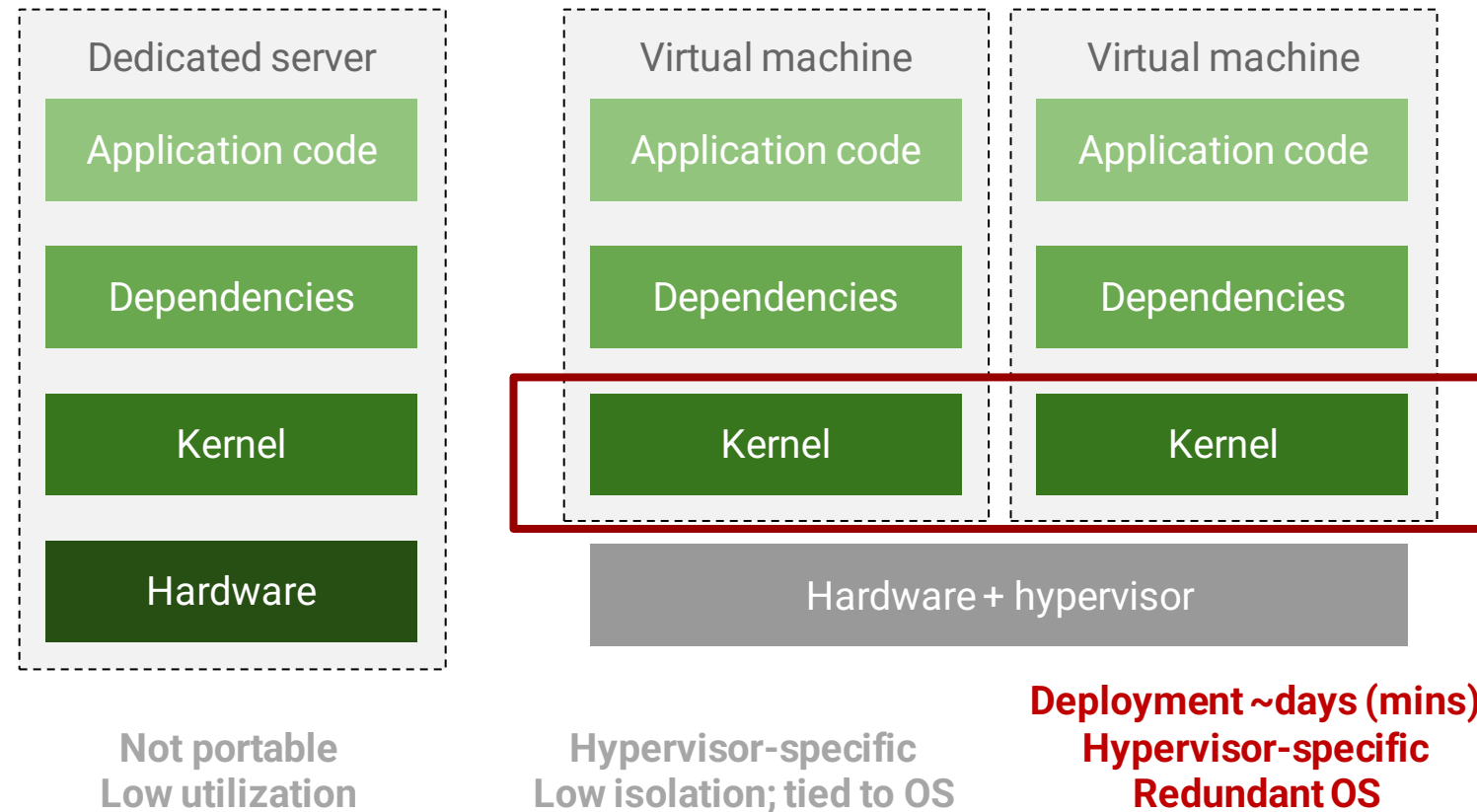


# Running multiple apps on a single VM

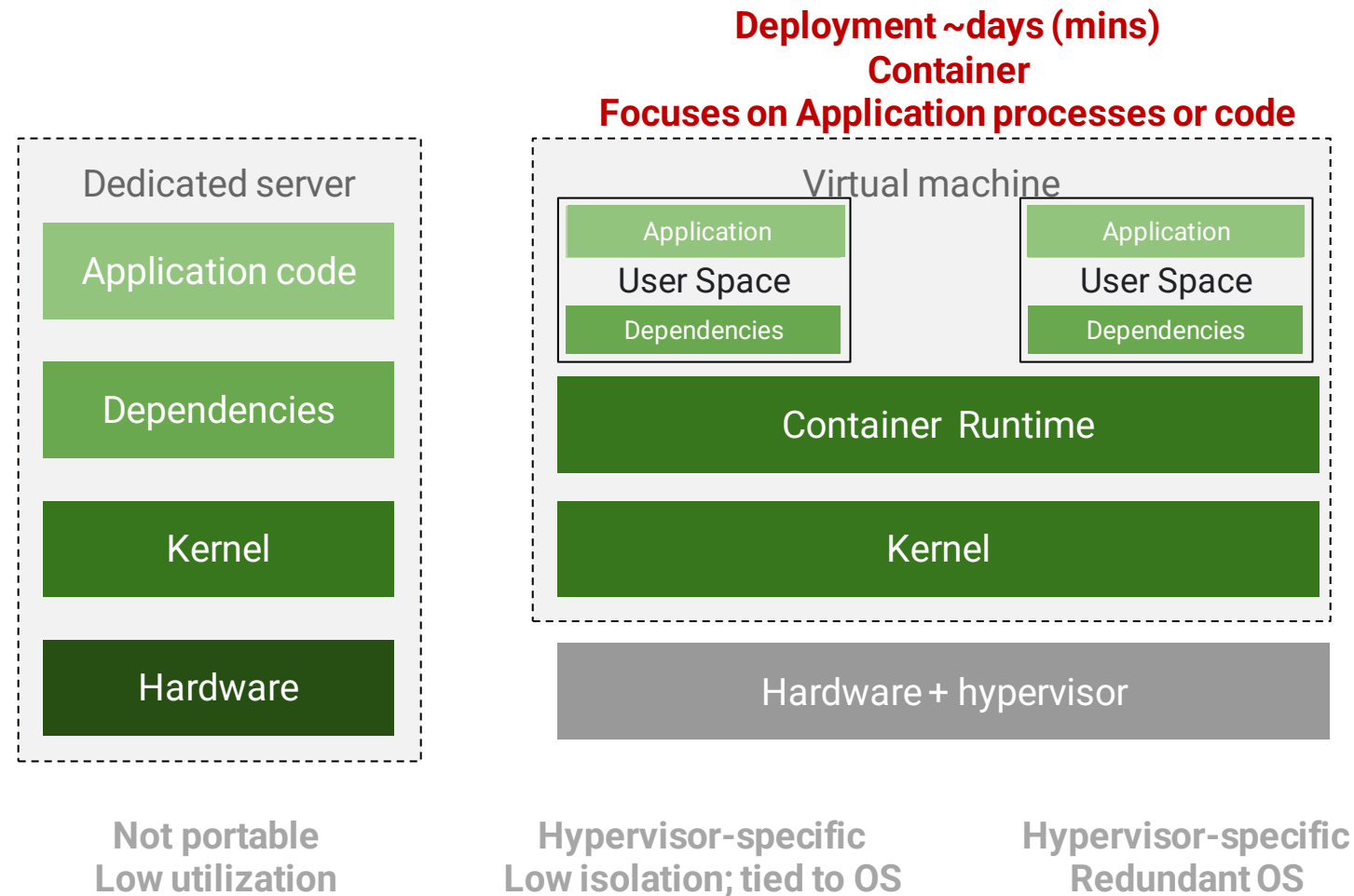




# The VM-centric way to solve this problem

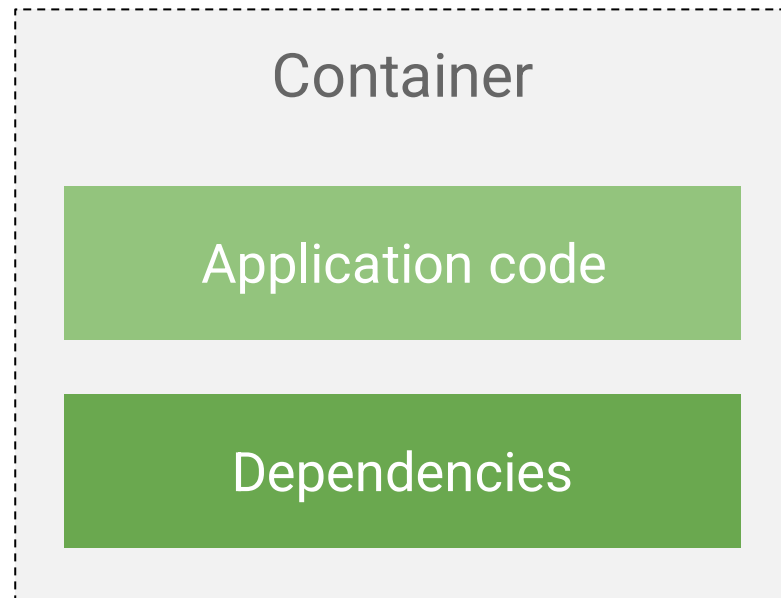


# User space abstraction and containers



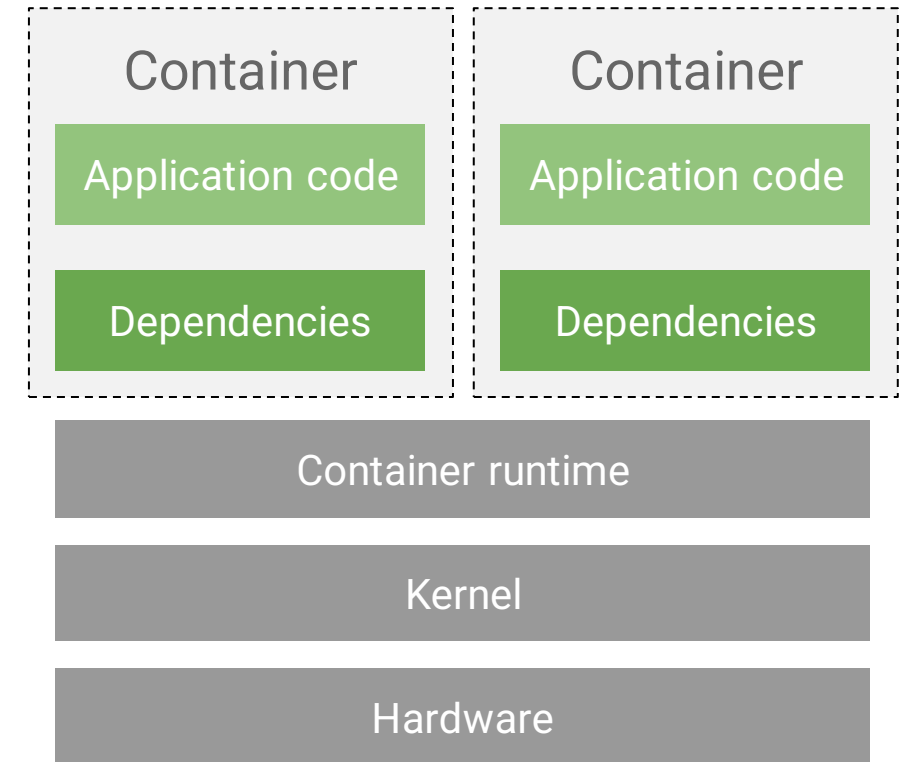
# Containers

are lightweight, standalone, resource-efficient, portable, executable packages



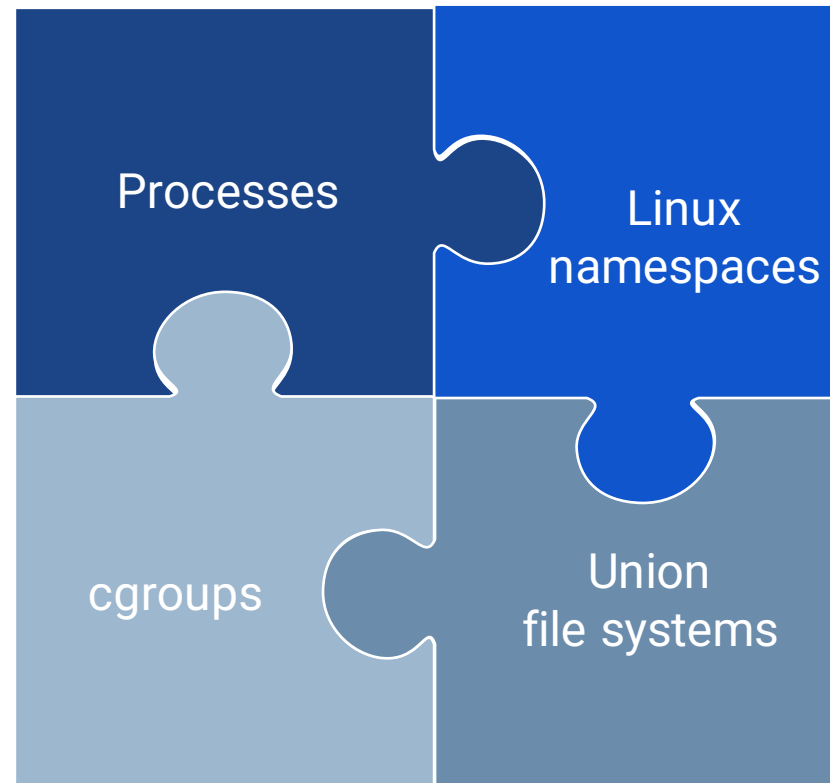
# Why developers like containers?

- Easier and faster to deploy
- Low hardware footprint
- Portable
- Universal format
  - Multi environment deployment
- Environment Isolation
  - Development, Testing and Production
- Reusability
- Ideal for microservices environment

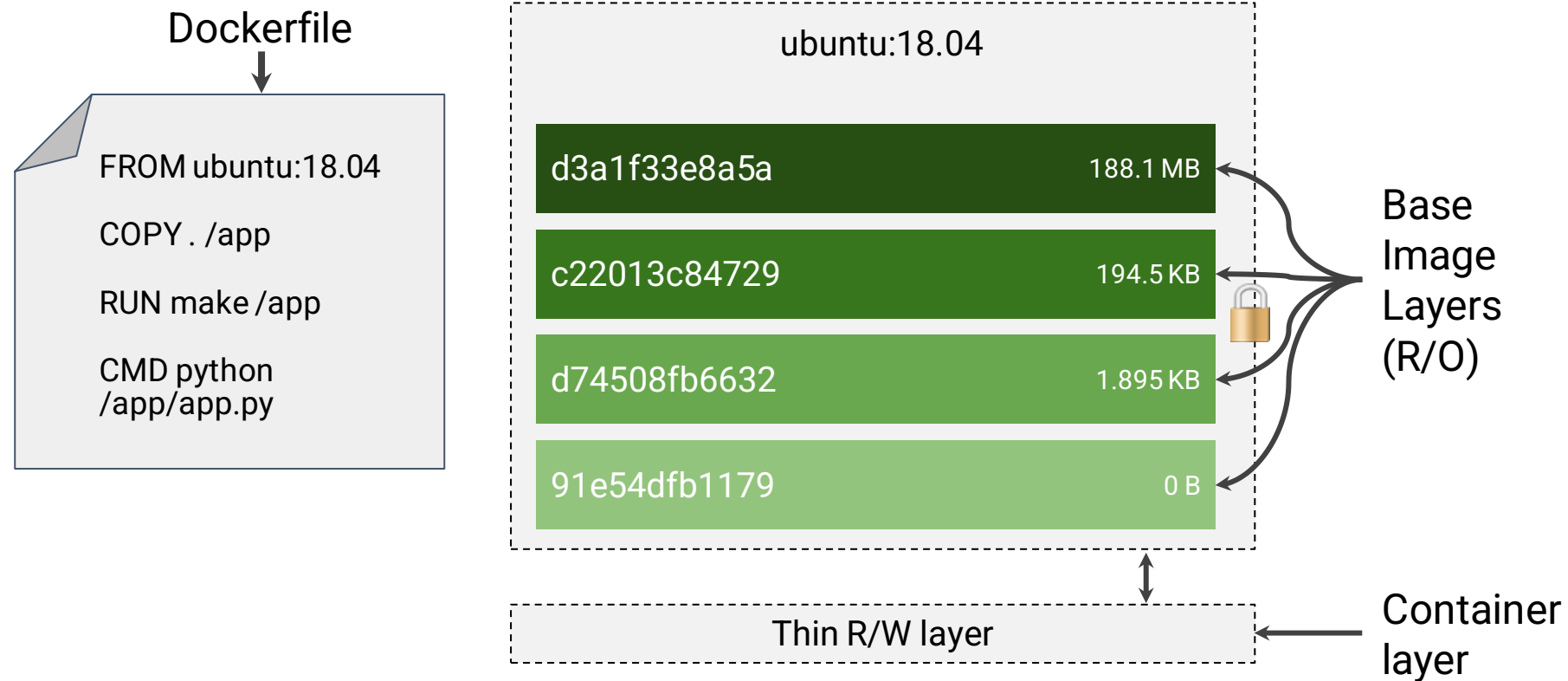


# Containers use a varied set of Linux technologies

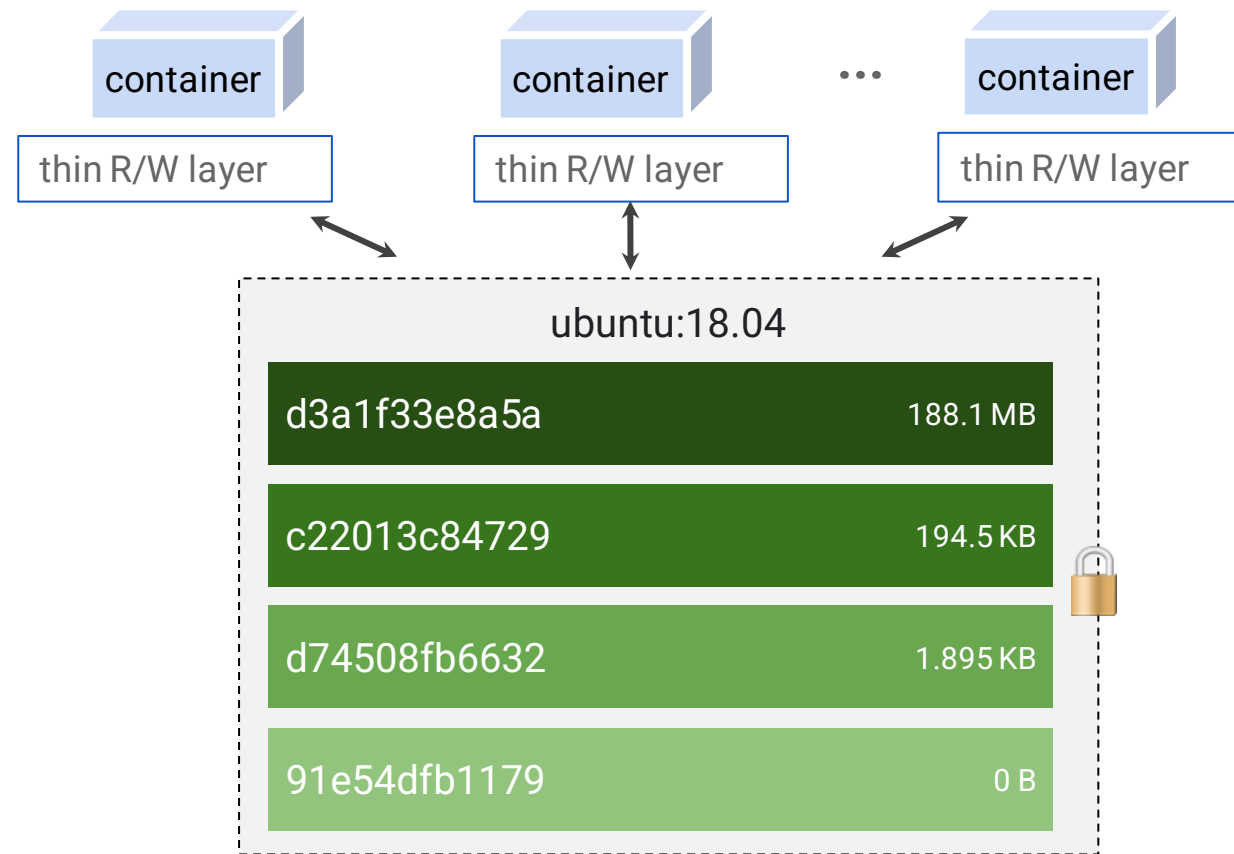
---



# Containers are structured in layers



# Containers promote smaller shared images



# Quiz 1

---

Which two options are examples of software applications that might run in a container? (Choose two.)

- a) A database-driven Python application accessing services such as a MySQL database, a file transfer protocol (FTP) server, and a web server on a single physical host.
- b) A Java Enterprise Edition application, with an Oracle database, and a message broker running on a single VM.
- c) An I/O monitoring tool responsible for analyzing the traffic and block data transfer.
- d) A memory dump application tool capable of taking snapshots from all the memory CPU caches for debugging purposes.



# Quiz 1

---

Which two options are examples of software applications that might run in a container? (Choose two.)

- a) A database-driven Python application accessing services such as a MySQL database, a file transfer protocol (FTP) server, and a web server on a single physical host.
- b) A Java Enterprise Edition application, with an Oracle database, and a message broker running on a single VM.
- c) An I/O monitoring tool responsible for analyzing the traffic and block data transfer.
- d) A memory dump application tool capable of taking snapshots from all the memory CPU caches for debugging purposes.

# Quiz 2

---

Which two of the following use cases are best suited for containers? (Choose two.)

- a) A software provider needs to distribute software that can be reused by other companies in a fast and error-free way.
- b) A company is deploying applications on a physical host and would like to improve its performance by using containers.
- c) Developers at a company need a disposable environment that mimics the production environment so that they can quickly test the code they develop.
- d) A financial company is implementing a CPU-intensive risk analysis tool on their own containers to minimize the number of processors needed.

# Quiz 2

---

Which two of the following use cases are best suited for containers? (Choose two.)

- a) A software provider needs to distribute software that can be reused by other companies in a fast and error-free way.
- b) A company is deploying applications on a physical host and would like to improve its performance by using containers.
- c) Developers at a company need a disposable environment that mimics the production environment so that they can quickly test the code they develop.
- d) A financial company is implementing a CPU-intensive risk analysis tool on their own containers to minimize the number of processors needed.

# Quiz 3

A company is migrating their PHP and Python applications running on the same host to a new architecture. Due to internal policies, both are using a set of custom made shared libraries from the OS, but the latest update applied to them as a result of a Python development team request broke the PHP application. Which two architectures would provide the best support for both applications? (Choose two.)

- a) Deploy each application to different VMs and apply the custom made shared libraries individually to each VM host.
- b) Deploy each application to different containers and apply the custom made shared libraries individually to each container.
- c) Deploy each application to different VMs and apply the custom made shared libraries to all VM hosts.
- d) Deploy each application to different containers and apply the custom made shared libraries to all containers.

# Quiz 3

A company is migrating their PHP and Python applications running on the same host to a new architecture. Due to internal policies, both are using a set of custom made shared libraries from the OS, but the latest update applied to them as a result of a Python development team request broke the PHP application. Which two architectures would provide the best support for both applications? (Choose two.)

- a) Deploy each application to different VMs and apply the custom made shared libraries individually to each VM host.
- b) Deploy each application to different containers and apply the custom made shared libraries individually to each container.
- c) Deploy each application to different VMs and apply the custom made shared libraries to all VM hosts.
- d) Deploy each application to different containers and apply the custom made shared libraries to all containers.

# Quiz 4

---

Which three kinds of applications can be packaged as containers for immediate deployment? (Choose three.)

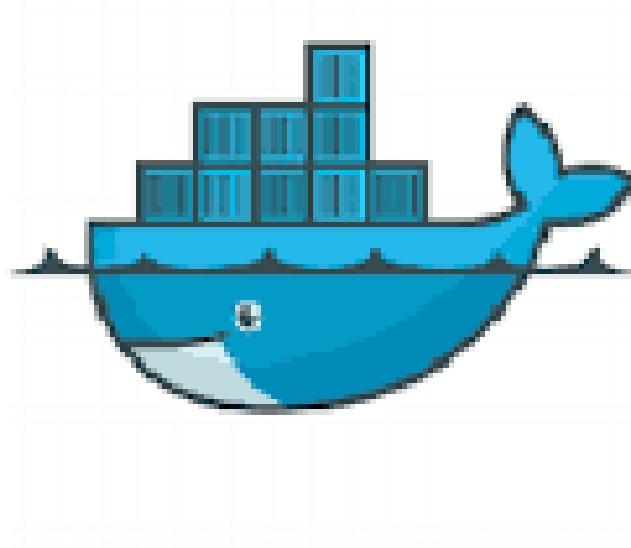
- a) A virtual machine hypervisor
- b) A blog software, such as WordPress
- c) A database
- d) A local file system recovery tool
- e) A web server

# Quiz 4

---

Which three kinds of applications can be packaged as containers for immediate deployment? (Choose three.)

- a) A virtual machine hypervisor
- b) A blog software, such as WordPress
- c) A database
- d) A local file system recovery tool
- e) A web server

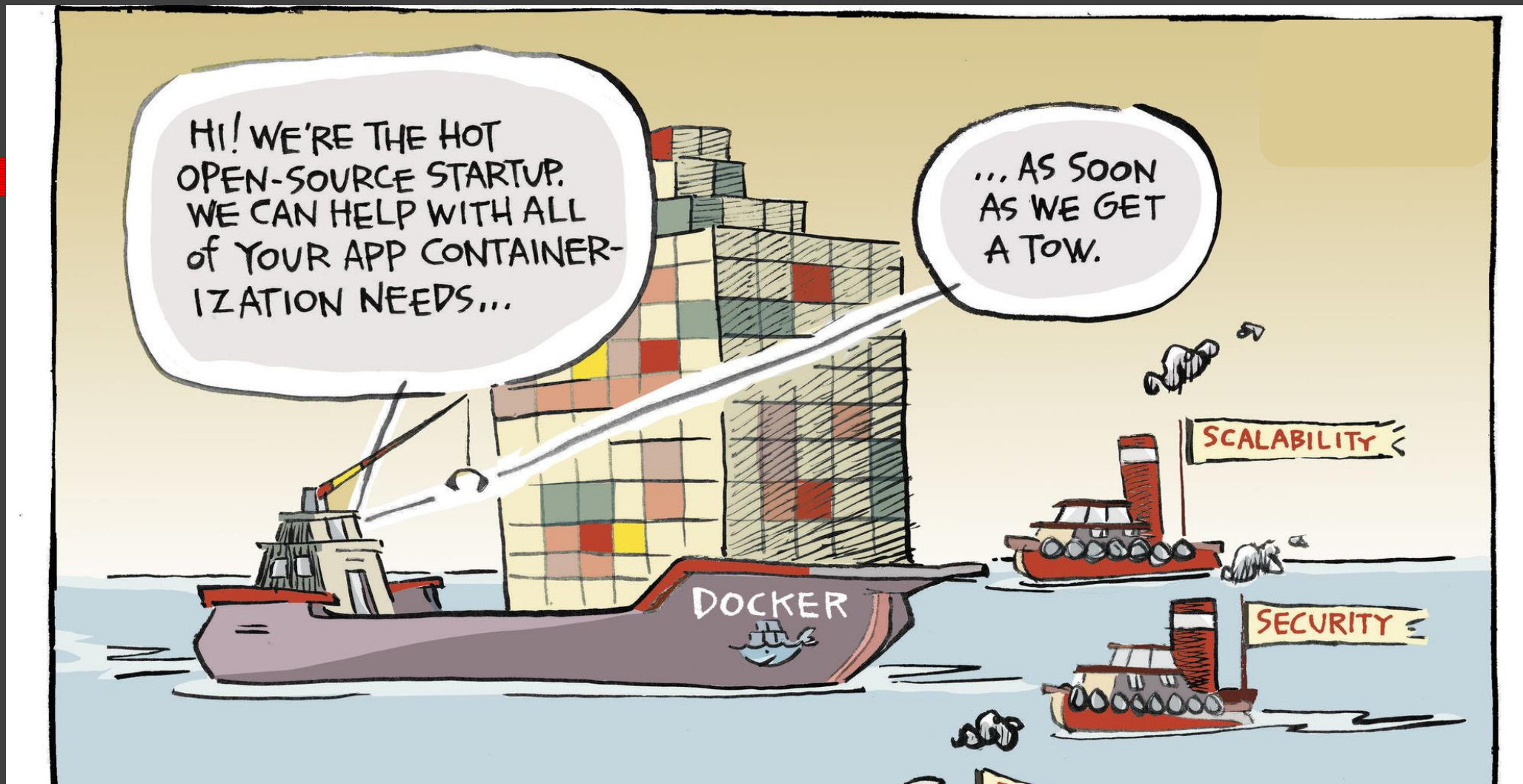


# Overview of Container Architecture

After completing this section, you will be able to:

- Describe the architecture of Linux containers.
- Install the podman utility to manage containers.



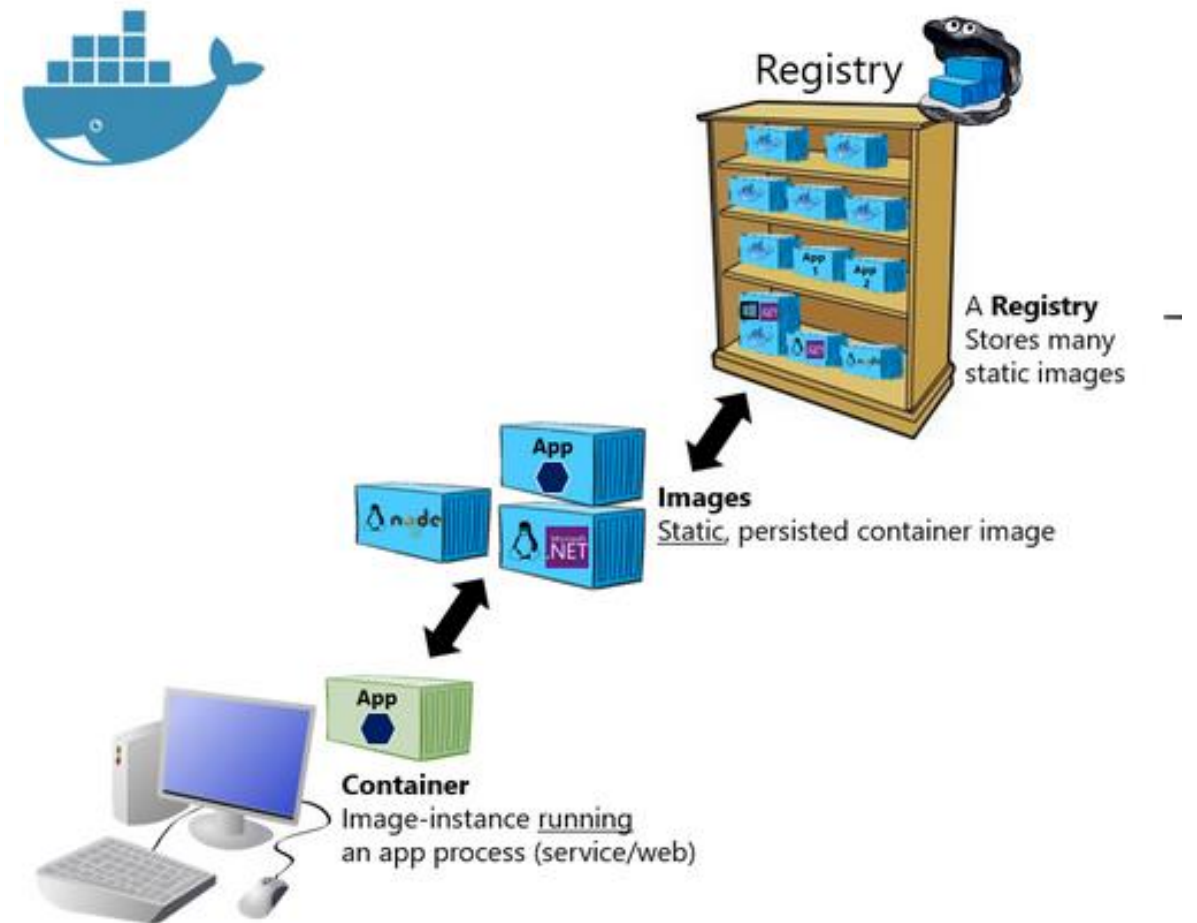


## Terminology

- Namespaces
- Control groups (cgroups)
- Seccomp
- SELinux

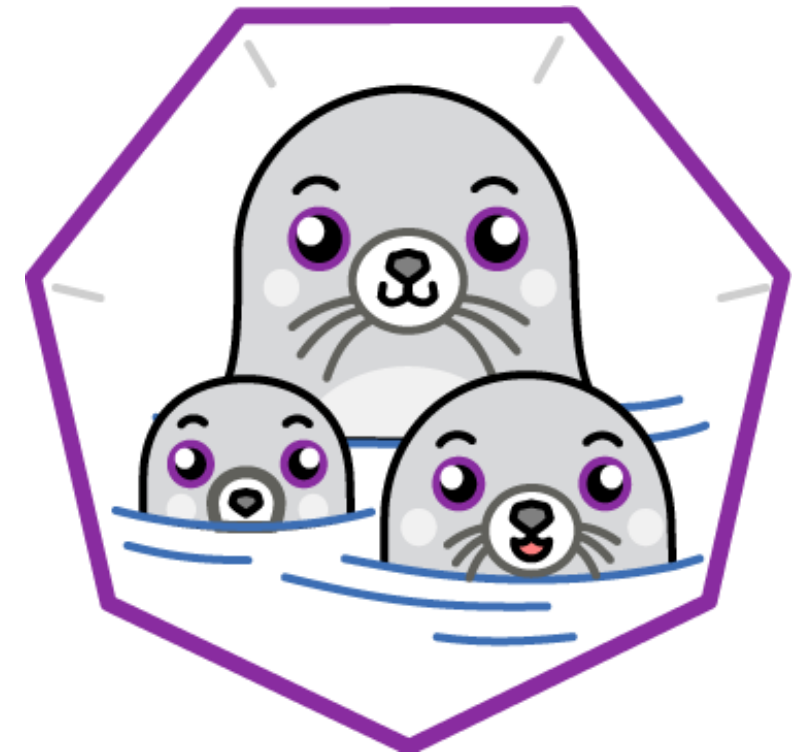
# Describing Linux Container Architecture

- Container is a process
- Start from image
- Immutable view of image
- Image versioning
  - Automation
  - Rapid provisioning
- Locally or remotely stored
- Image Repository
  - Docker Hub - [docker.io](https://docker.io)
  - Red Hat Container Catalog - [access.redhat.registry](https://access.redhat.com/registry)
  - Red Hat Quay - [quay.io](https://quay.io)
  - Google Container Registry - [gcr.io](https://gcr.io)
  - Amazon Elastic Container Registry – [ecr.io](https://ecr.io)



# Managing Containers with Podman

- Build image
- Search image from local or remote registry
- Uses Open Container Initiative (OCI) specification
- Improvised from Docker cli
- Compatible with K8s.
- Install Podman
  - # sudo yum install podman or
  - # sudo dnf install podman



# Quiz 1

---

1. Which three of following Linux features are used for running containers?

(Choose three.)

- a) Namespaces
- b) Integrity Management
- c) Security-Enhanced Linux
- d) Control Groups

# Quiz 1

---

1. Which three of following Linux features are used for running containers?

(Choose three.)

- a) Namespaces
- b) Integrity Management
- c) Security-Enhanced Linux
- d) Control Groups

# Quiz 2

---

Which of the following best describes a container image?

- a) A virtual machine image from which a container will be created.
- b) A container blueprint from which a container will be created.
- c) A runtime environment where an application will run.
- d) The container's index file used by a registry.

# Quiz 2

---

Which of the following best describes a container image?

- a) A virtual machine image from which a container will be created.
- b) A container blueprint from which a container will be created.
- c) A runtime environment where an application will run.
- d) The container's index file used by a registry.

# Quiz 3

---

Which three of the following components are common across container architecture implementations? (Choose three.)

- a) Container runtime
- b) Container permissions
- c) Container images
- d) Container registries



# Quiz 3

---

Which three of the following components are common across container architecture implementations? (Choose three.)

- a) Container runtime
- b) Container permissions
- c) Container images
- d) Container registries

# Quiz 4

---

What is a container in relation to the Linux kernel?

- a) A virtual machine.
- b) An isolated process with regulated resource access.
- c) A set of file-system layers exposed by UnionFS.
- d) An external service providing container images.

# Quiz 4

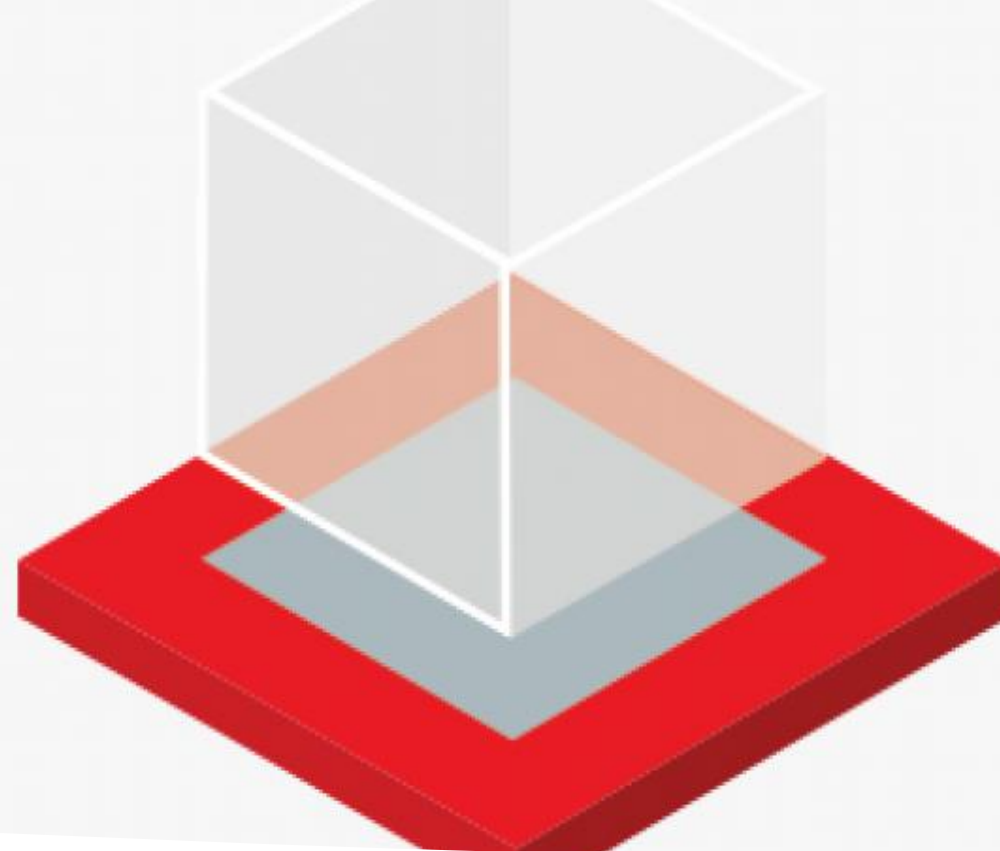
---

What is a container in relation to the Linux kernel?

- a) A virtual machine.
- b) An isolated process with regulated resource access.
- c) A set of file-system layers exposed by UnionFS.
- d) An external service providing container images.



# Red Hat OpenShift



## Overview of Kubernetes and OpenShift

After completing this section, you will be:

- Identifying the limitations of Linux containers and the need for container orchestration.
- Describing the Kubernetes container orchestration tool.
- Describing Red Hat OpenShift Container Platform (RHOC).

# Limitations of Linux containers and the need for container orchestration.

- Cannot scale seamlessly
- Manually starting on different node
- Doesn't works seamlessly on multi-node environment
- Doesn't works seamlessly on multi-platform environment
- Manual migration
- Slow in reacting to service deterioration
- Manual update

# Kubernetes Features

---

- Simplifies deployment and management
- Automate scaling
- Auto-healing or Self-healing
- Automated rollout
- Secrets and configuration management
- Multi-platform
  - Windows
  - Linuxes
- Hybrid platform
  - On-prem
  - In the cloud
- Fully managed life cycle operations

# OpenShift Overview

---

- Red Hat OpenShift Container Platform (RHOCP)
- Set of modular components and services
- Based on Kubernetes specifications
- Enhanced capabilities:
  - Remote Management
  - Multitenancy
  - Increased Security
  - Monitoring and Auditing
- With OCPv4, implement CoreOS

# OpenShift Features

---

- OpenShift adds the following features to a Kubernetes cluster
- Built-in container registry
- CI/CD pipelines,
- Source-to-Image (S2I)
- Easily expose services to outside world
- Metrics and Logging
- Unified UI



# Quiz 1

---

Which three of the following statements are correct regarding container limitations? (Choose three.)

- a) Containers are easily orchestrated in large numbers.
- b) Lack of automation increases response time to problems.
- c) Containers do not manage application failure inside them.
- d) Containers are not load-balanced.
- e) Containers are heavily isolated packaged applications.

# Quiz 1

---

Which three of the following statements are correct regarding container limitations? (Choose three.)

- a) Containers are easily orchestrated in large numbers.
- b) Lack of automation increases response time to problems.
- c) Containers do not manage application failure inside them.
- d) Containers are not load-balanced.
- e) Containers are heavily isolated packaged applications.

# Quiz 2

---

Which two of the following statements are correct regarding Kubernetes?  
(Choose two.)

- a) Kubernetes is a container.
- b) Kubernetes can only use Docker containers.
- c) Kubernetes is a container orchestration system.
- d) Kubernetes simplifies management, deployment, and scaling of containerized applications.
- e) Applications managed in a Kubernetes cluster are harder to maintain.

# Quiz 2

---

Which two of the following statements are correct regarding Kubernetes?  
(Choose two.)

- a) Kubernetes is a container.
- b) Kubernetes can only use Docker containers.
- c) Kubernetes is a container orchestration system.
- d) Kubernetes simplifies management, deployment, and scaling of containerized applications.
- e) Applications managed in a Kubernetes cluster are harder to maintain.

# Quiz 3

---

3. Which three of the following statements are true regarding Red Hat OpenShift v4? (Choose three.)
- a) OpenShift provides additional features to a Kubernetes infrastructure.
  - b) Kubernetes and OpenShift are mutually exclusive.
  - c) OpenShift hosts use Red Hat Enterprise Linux as the base operating system.
  - d) OpenShift simplifies development incorporating a Source-to-Image technology and CI/CD pipelines.
  - e) OpenShift simplifies routing and load balancing.

# Quiz 3

---

3. Which three of the following statements are true regarding Red Hat OpenShift v4? (Choose three.)
- a) OpenShift provides additional features to a Kubernetes infrastructure.
  - b) Kubernetes and OpenShift are mutually exclusive.
  - c) OpenShift hosts use Red Hat Enterprise Linux as the base operating system.
  - d) OpenShift simplifies development incorporating a Source-to-Image technology and CI/CD pipelines.
  - e) OpenShift simplifies routing and load balancing.

# Quiz 4

---

What features does OpenShift offer that extend Kubernetes capabilities? (choose two.)

- a) Operators and the Operator Framework.
- b) Routes to expose services to the outside world.
- c) An integrated development workflow.
- d) Self-healing and health checks.


# Quiz 4

---

What features does OpenShift offer that extend Kubernetes capabilities? (choose two.)

- a) Operators and the Operator Framework.
- b) Routes to expose services to the outside world.
- c) An integrated development workflow.
- d) Self-healing and health checks.





## Guided Exercise: Configuring the Classroom Environment

### You should be able to:

- Configure your workstation machine to access an OpenShift cluster, a container image registry, and a Git repository used throughout the course.
- Fork the Red Hat DO180 sample applications repository to your personal GitHub account.
- Clone the DO180 sample applications repository from your personal GitHub account to your workstation machine.

# Chapter Summary

---

In this chapter, you learned:

- Containers are an isolated application runtime created with very little overhead.
- A container image packages an application with all of its dependencies, making it easier to run the application in different environments.
- Applications such as Podman create containers using features of the standard Linux kernel.
- Container image registries are the preferred mechanism for distributing container images to multiple users and hosts.
- OpenShift orchestrates applications composed of multiple containers using Kubernetes.
- Kubernetes manages load balancing, high availability, and persistent storage for containerized applications.
- OpenShift adds to Kubernetes multitenancy, security, ease of use, and continuous integration and continuous development features.
- OpenShift routes enable external access to containerized applications in a manageable way.