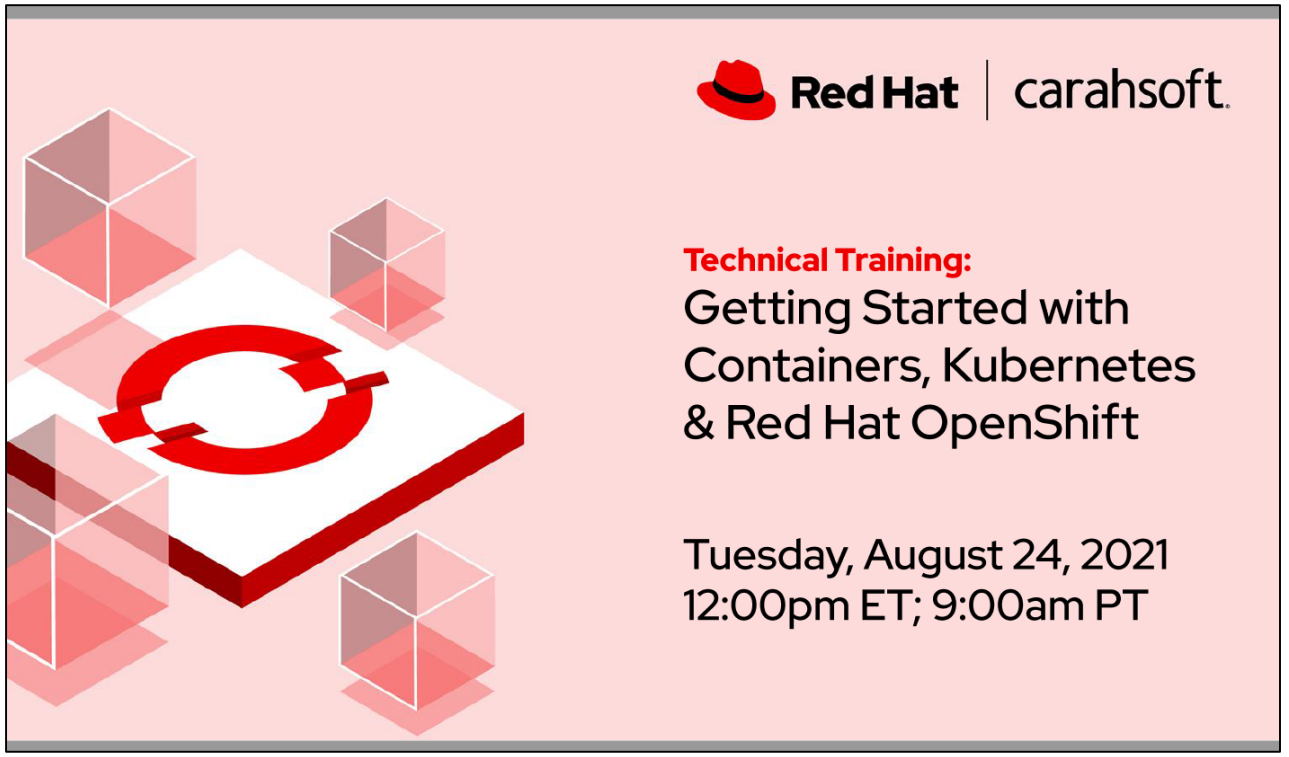
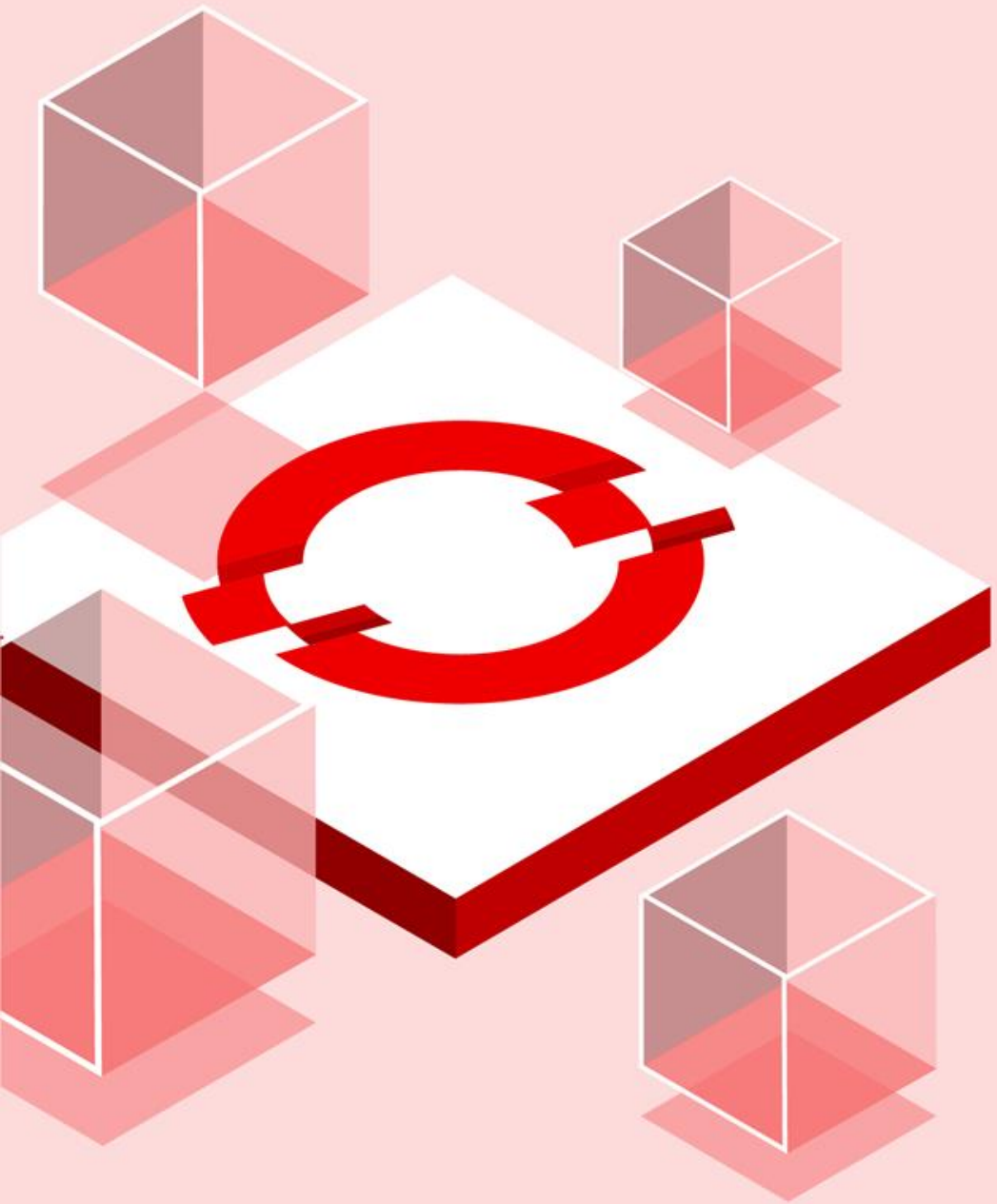
Red Hat

Getting Started with Containers, Kubernetes and Red Hat OpenShift

Technical Training for Academic Institutions





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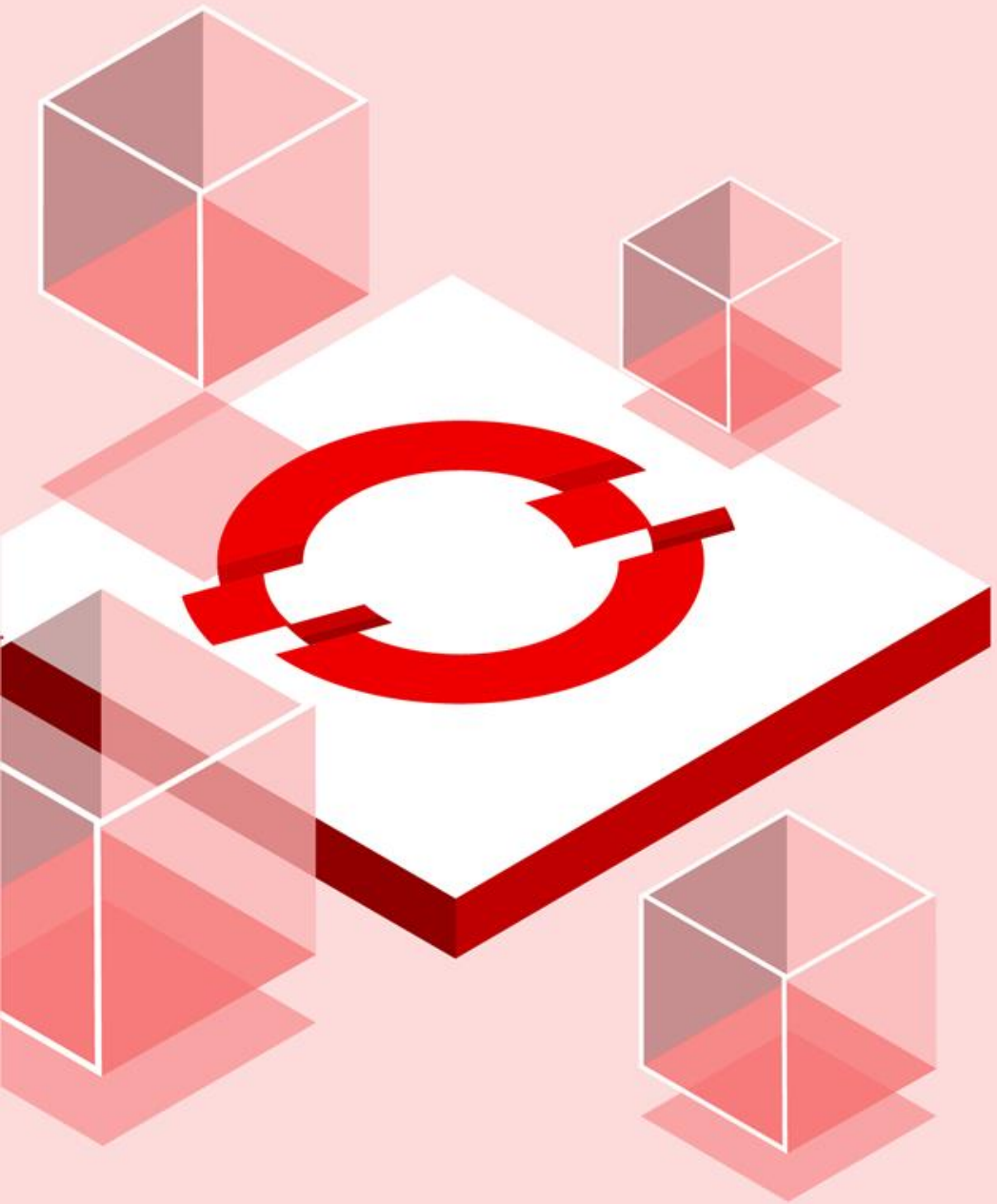
Technical Training:

Getting Started with Containers, Kubernetes & Red Hat OpenShift

Tuesday, August 24, 2021
12:00pm ET; 9:00am PT

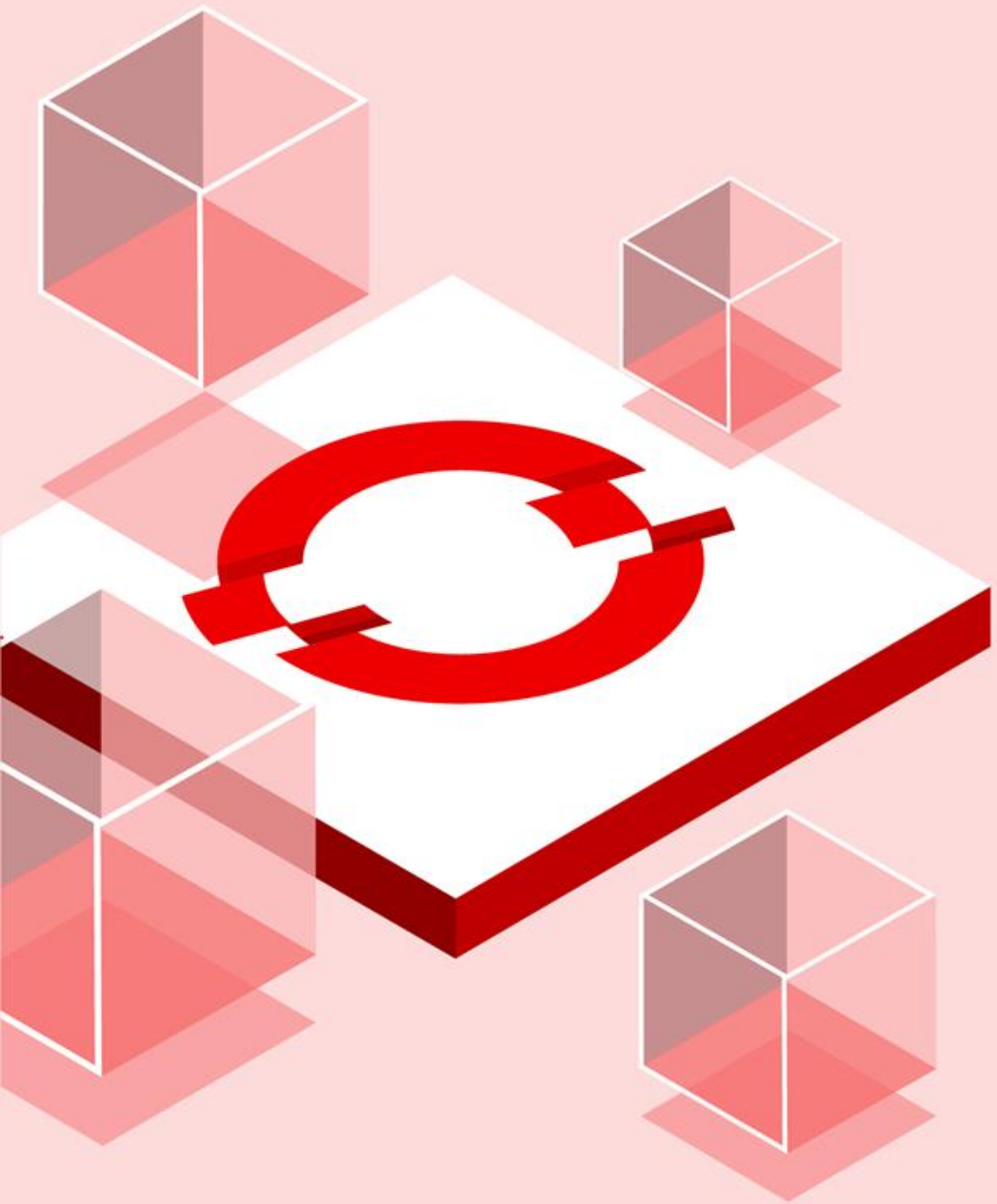


Connor Murray

Red Hat Account Manager

703-230-7583

Connor.Murray@carahsoft.com



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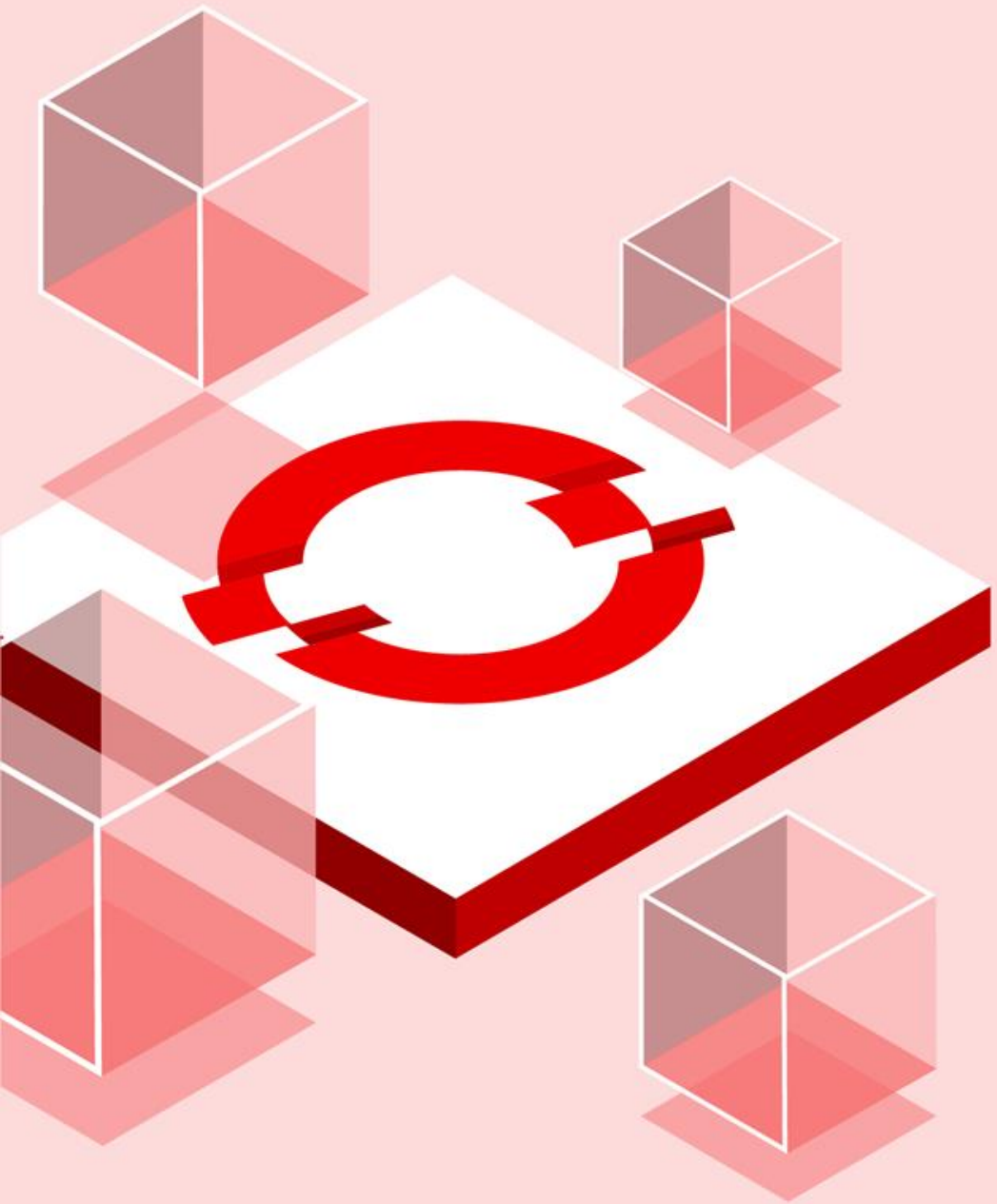
About Carahsoft

Carahsoft is a leading IT distributor and top-performing E&I, Internet2, NJSBA and The Quilt contract holder, enhancing student learning and enabling faculty to meet the needs of Higher Education institutions and K-12 schools.



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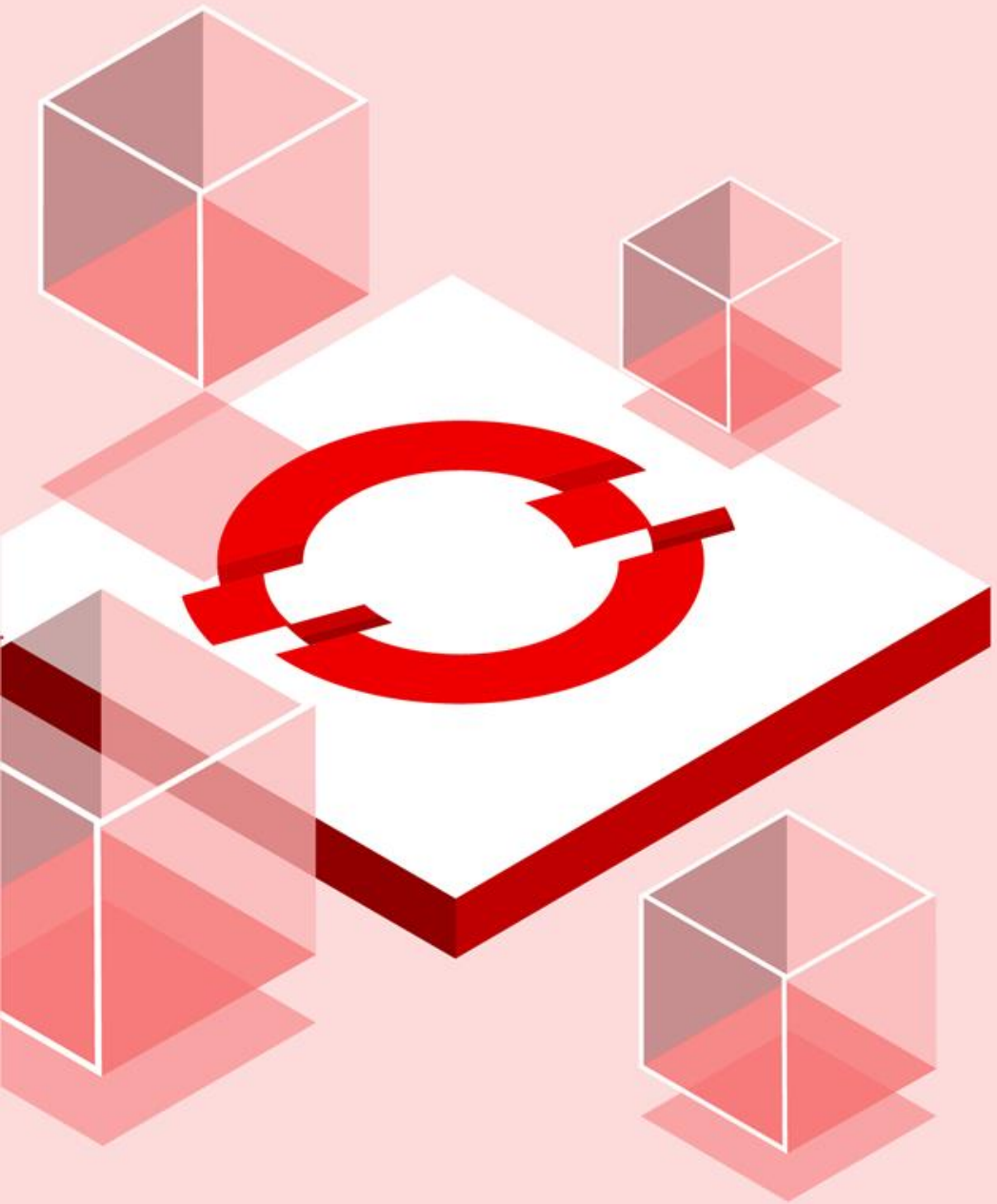
Red Hat OpenShift

The leading hybrid cloud, enterprise Kubernetes platform

Red Hat OpenShift is an enterprise-ready Kubernetes container platform with full-stack automated operations to manage hybrid cloud, multicloud, and edge deployments. Red Hat OpenShift is optimized to improve developer productivity and promote innovation.



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Featured Expert:

John Walter
Specialist Solutions Architect,
Training and Certification,
Red Hat

Red Hat
Training and
Certification

Kubernetes 101

An introduction to containers, Kubernetes, and OpenShift

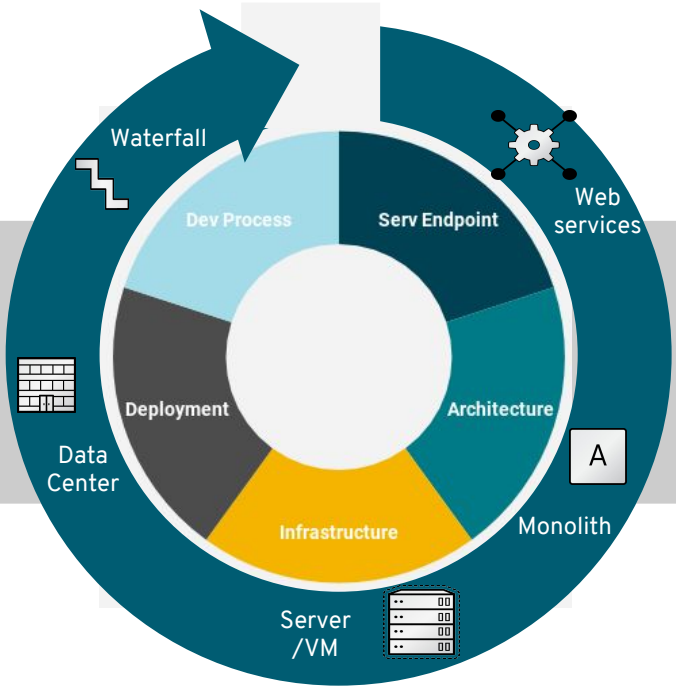
John Walter, Solutions Architect

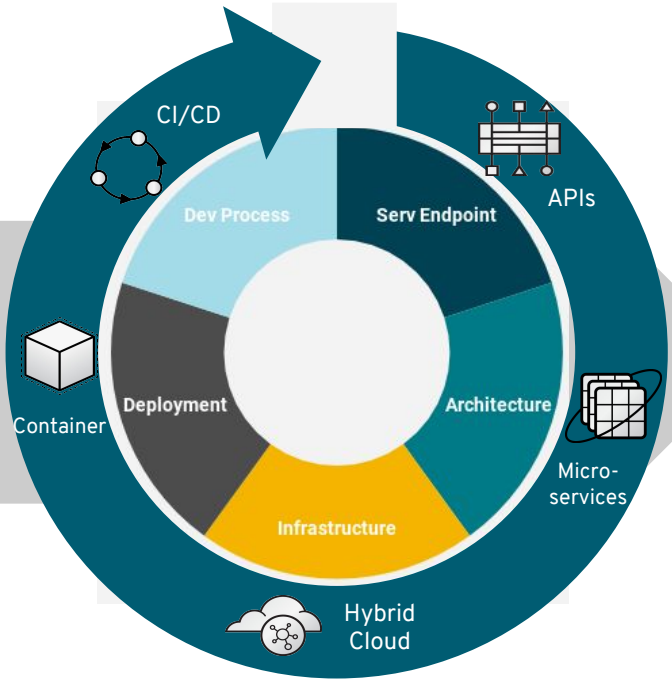
AGENDA

- Why containers?
- What is Kubernetes?
- What is OpenShift?
- **BREAK**
- Why Kubernetes?
- What is Kubernetes? Part 2
- **BREAK**
- Guided demonstrations **(with BREAKS)**
- Red Hat OpenShift Training
- Q&A

Why containers?

NEW PATTERNS FOR DEVELOPMENT





Speed

Agility

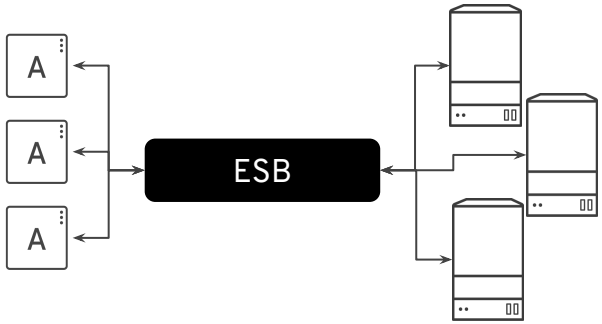
Control

OUTCOMES

Red Hat

AGILE INTEGRATION

Traditional integration incompatible with Cloud development



Centralize ♦ Leverage ♦ Simplify

Internal teams ♦ Maximize use of resources

Modern architectures and app development requires more agile integration

Distributed Integration ♦ Scalability ♦ Reusability

Agile Teams ♦ Distributed App Dev

USE INTEGRATION WHERE NEEDED, RATHER THAN CENTRALIZING

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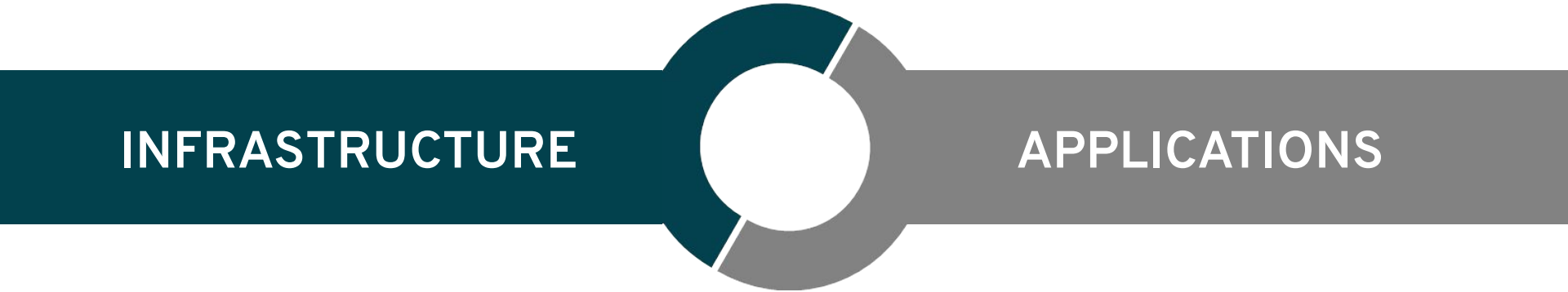
WHAT ARE CONTAINERS?

It Depends Who You Ask

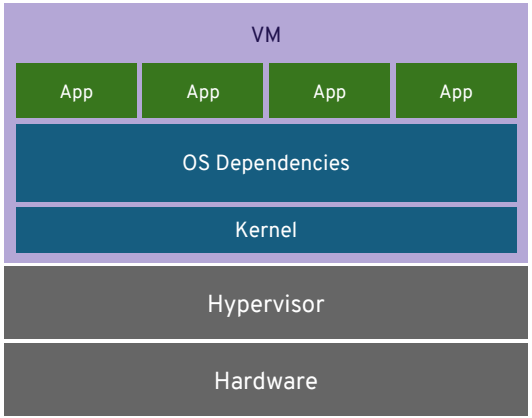


- Application processes on a shared kernel
- Simpler, lighter, and denser than VMs
- Portable across different environments

- Package apps with all dependencies
- Deploy to any environment in seconds
- Easily accessed and shared

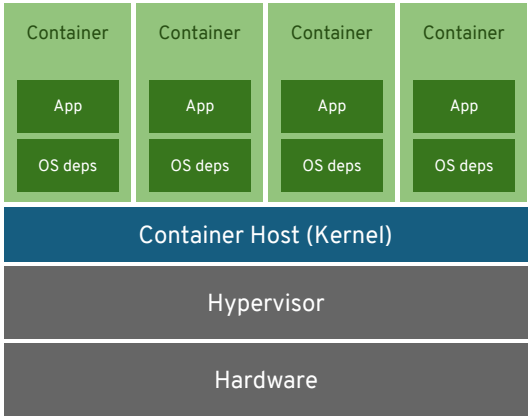
VIRTUAL MACHINES AND CONTAINERS

VIRTUAL MACHINES



VM isolates the hardware

CONTAINERS



Container isolates the process

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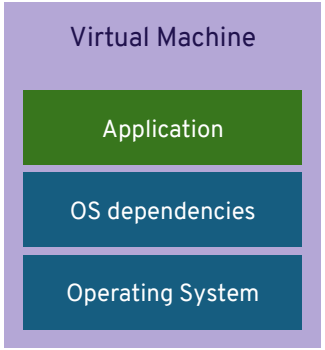
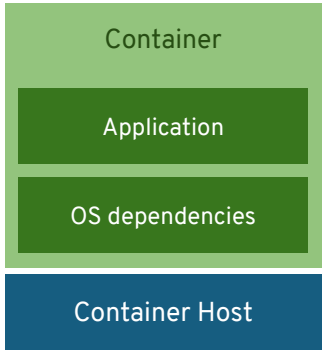
VIRTUAL MACHINES AND CONTAINERS





- \+ VM Isolation
- − Complete OS
- − Static Compute
- − Static Memory
- − High Resource Usage

- \+ Container Isolation
- \+ Shared Kernel
- \+ Burstable Compute
- \+ Burstable Memory
- \+ Low Resource Usage

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VIRTUAL MACHINES AND CONTAINERS

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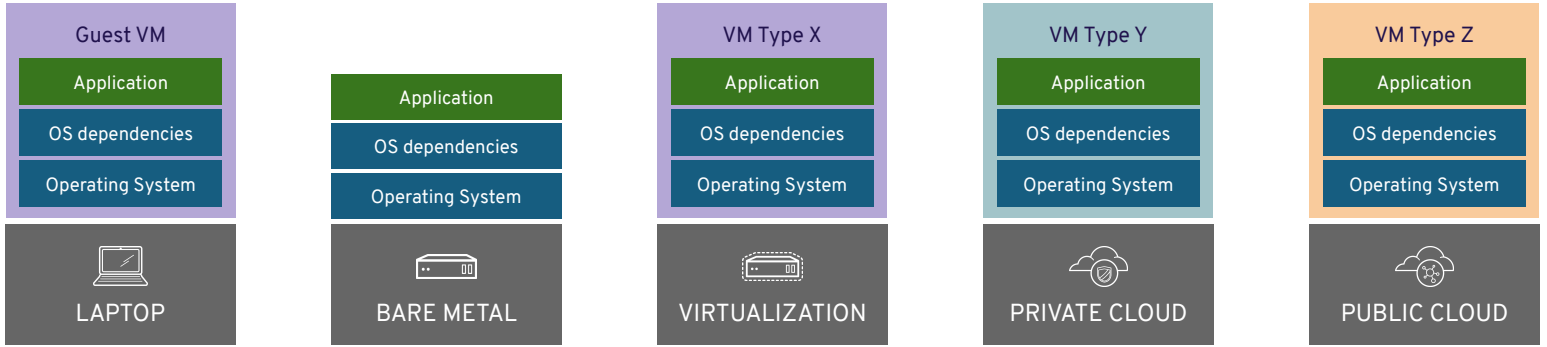
APPLICATION PORTABILITY WITH VM

Virtual machines are NOT portable across hypervisor and do NOT provide portable packaging for applications



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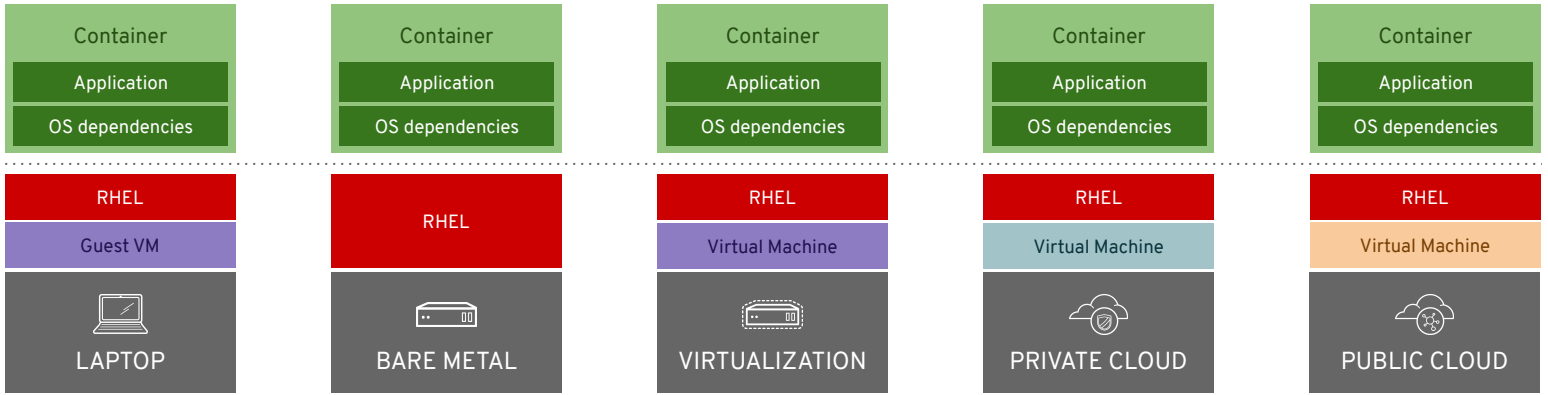
APPLICATION PORTABILITY WITH CONTAINERS

RHEL Containers + RHEL Host = Guaranteed Portability
Across Any Infrastructure



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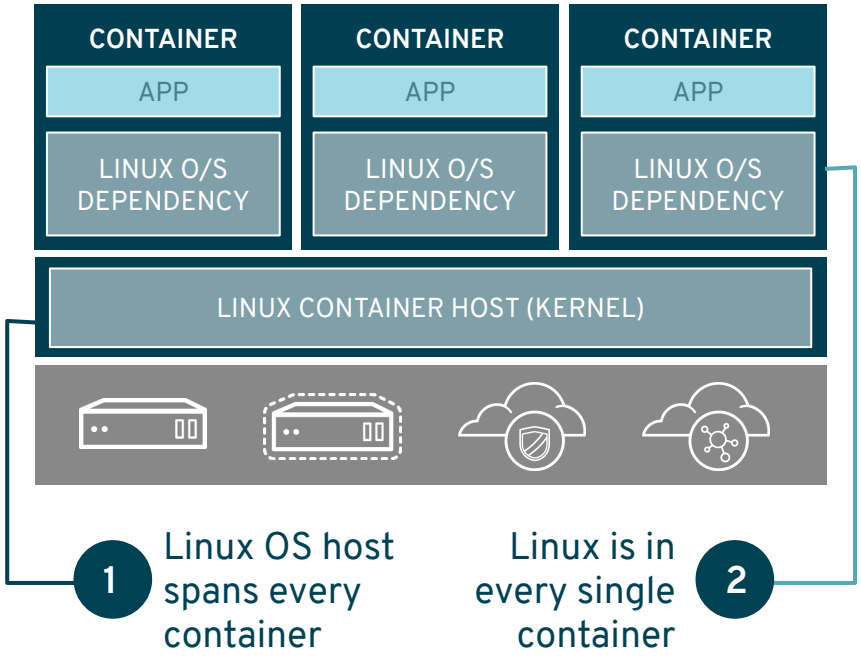
LINUX AND CONTAINER INFRASTRUCTURE



CONTAINERS ARE LINUX

Red Hat Enterprise Linux is a leader in paid Linux

70%

CY2016 paid Linux share

Red Hat

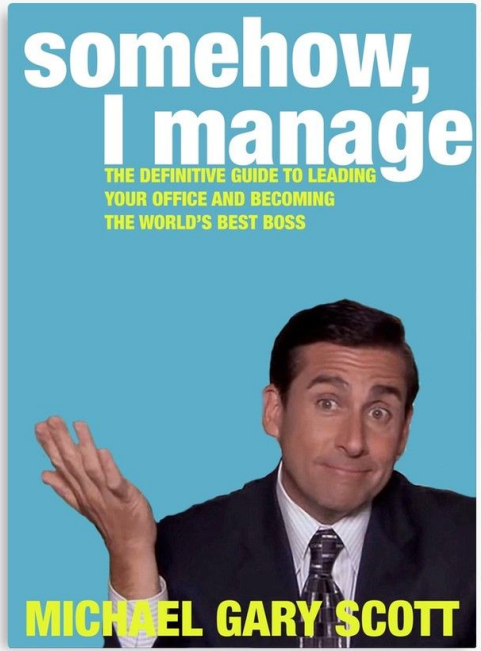
CONTAINERS IN A NUTSHELL

- Application portability across hybrid cloud environments
- Allow developers to focus on their application vs. underlying infrastructure
- Deployed for shorter periods of time than VMs
- Removing complexity through minimalism
- **Presents new challenges for Operations teams**

What is Kubernetes?

HOW DO I MANAGE THESE CONTAINERS?

- How do I manage configuration, service discovery, and resource scaling?
- Where do I configure my cluster?
- How do I update my applications?
- How do I update the underlying cluster?
- How can I simplify my complex applications?



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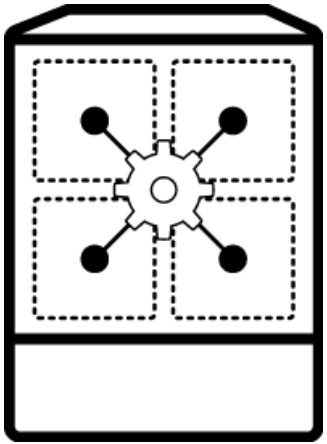
KUBERNETES IN A NUTSHELL

- Application portability across hybrid cloud environments
- Allow developers to focus on their application vs. underlying infrastructure
- Deployed for shorter periods of time than VMs
- Removing complexity through minimalism
- **Presents new challenges for Operations teams**

KUBERNETES AS CONTAINER ORCHESTRATION

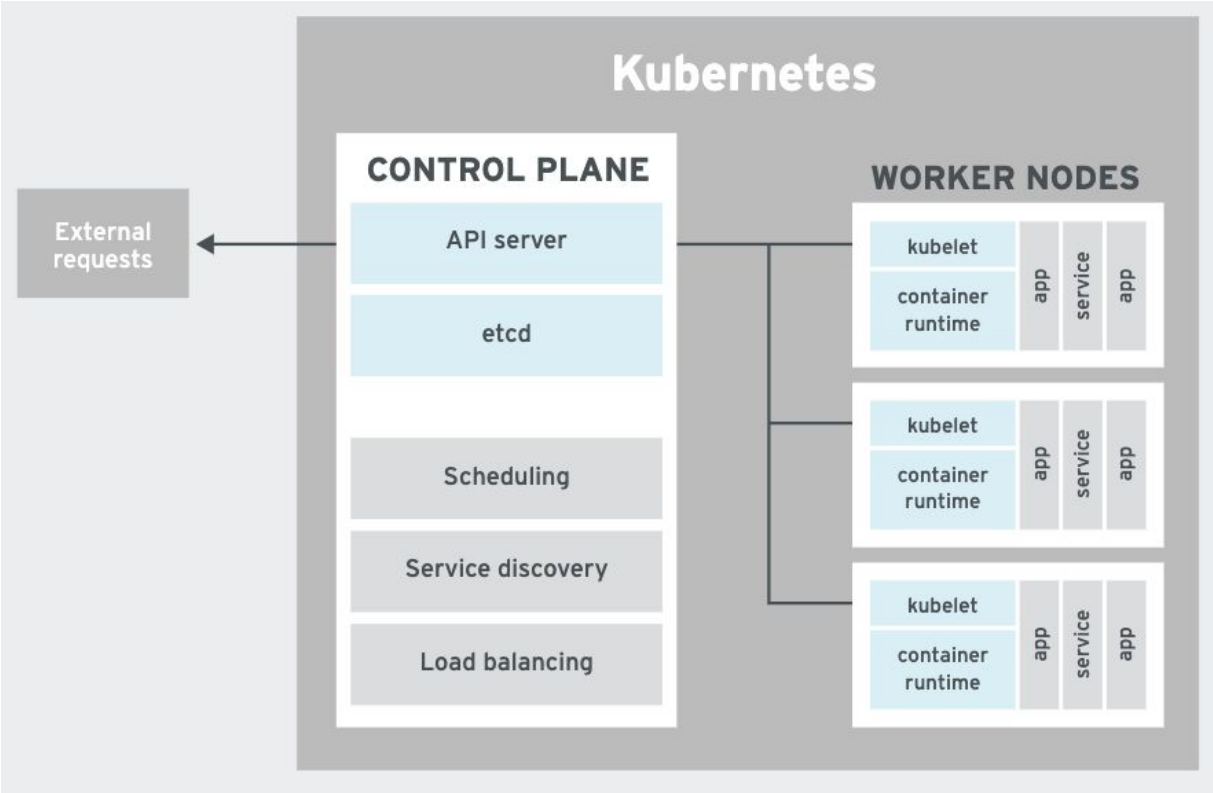
- Schedulers and scheduling
- Service discovery and load balancing
- Resource management



THE BENEFITS OF KUBERNETES

- Scalability
- Portability
- Consistent deployments
- Separated and automated operations and development

BASIC KUBERNETES ARCHITECTURE



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Deployment Topologies

Storage

RBAC

Operating Systems

Containers

Scaling

Alerting

Telemetry

Log Aggregation

Metrics

WHY SO HARD?

High Availability

Image Management

Security

Self Healing

Patching

VMs

Networking

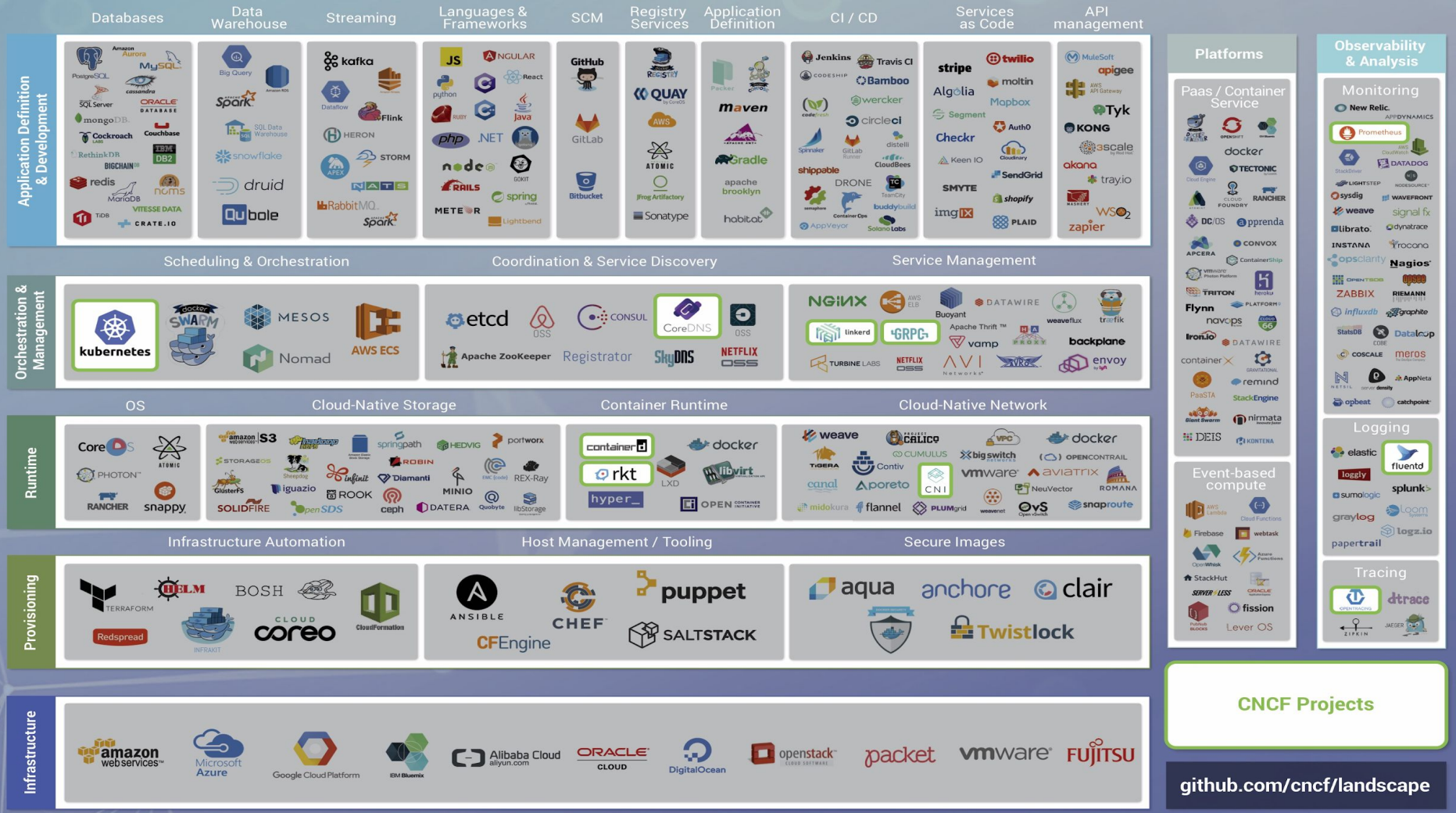
Monitoring

App Servers

Routing

Configuration Management

Red Hat


Databases
Data Warehouse
Streaming
Languages & Frameworks
SCM
Registry Services
Application Definition
CI / CD
Services as Code
API management
Application Definition & Development
Scheduling & Orchestration
Coordination & Service Discovery
Service Management
Orchestration & Management
OS
Cloud-Native Storage
Container Runtime
Cloud-Native Network
Runtime
Infrastructure Automation
Host Management / Tooling
Secure Images
Provisioning
Infrastructure
Platforms
Paas / Container Service
Event-based compute
Observability & Analysis
Monitoring
Logging
Tracing
CNCF Projects
github.com/cncf/landscape

Kubernetes done right is hard

INSTALL	DEPLOY	HARDEN	OPERATE
• Templating	• Identity & security access	• Platform monitoring & alerts	• OS upgrade & patch
• Validation	• App monitoring & alerts	• Metering & chargeback	• Platform upgrade & patch
• OS setup	• Storage & persistence	• Platform security hardening	• Image upgrade & patch
	• Egress, ingress, & integration	• Image hardening	• App upgrade & patch
	• Host container images	• Security certifications	• Security patches
	• Build/Deploy methodology	• Network policy	• Continuous security scanning
		• Disaster recovery	• Multi-environment rollout
		• Resource segmentation	• Enterprise container registry
			• Cluster & app elasticity
			• Monitor, alert, remediate
			• Log aggregation

75%

of enterprise users identify complexity of implementation and operations as the top blocker to adoption

Source: The New Stack. *The State of the Kubernetes Ecosystem*, August 2017.

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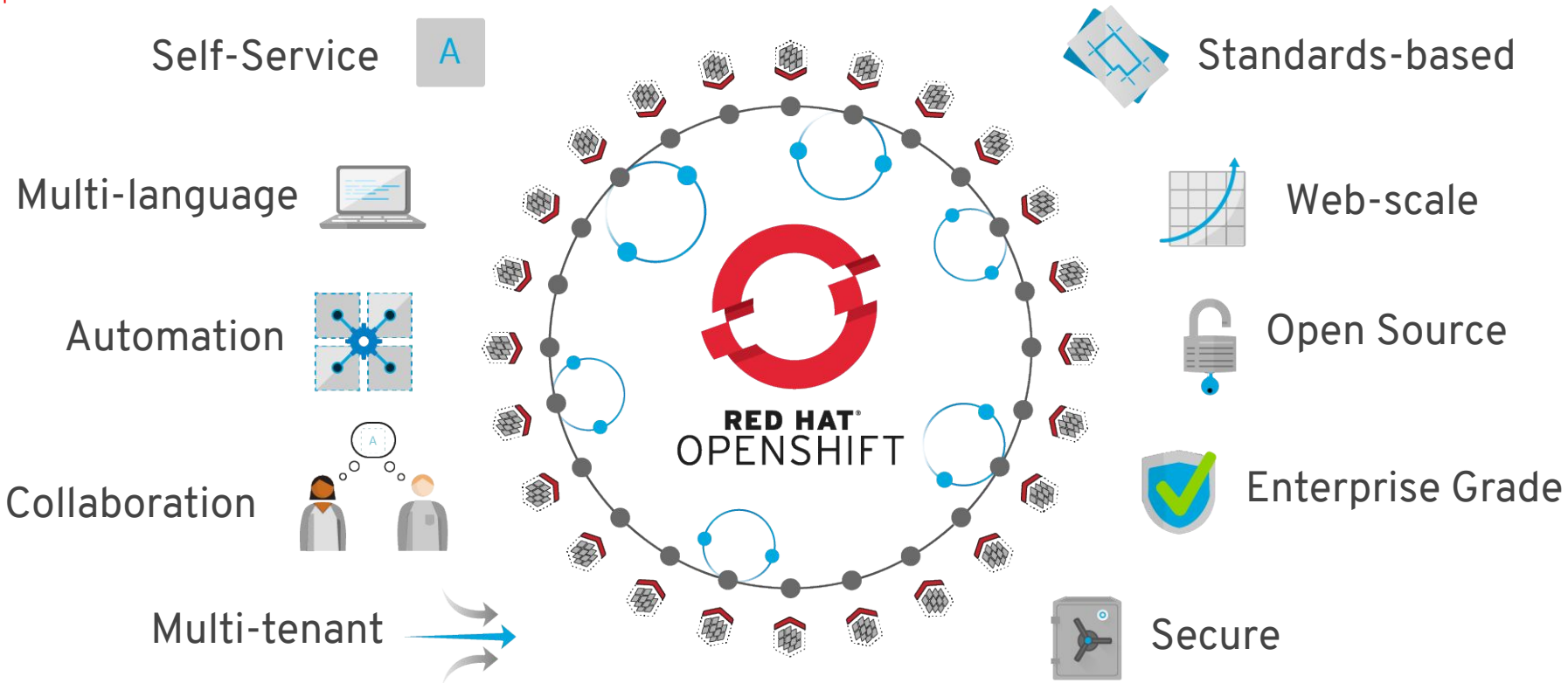
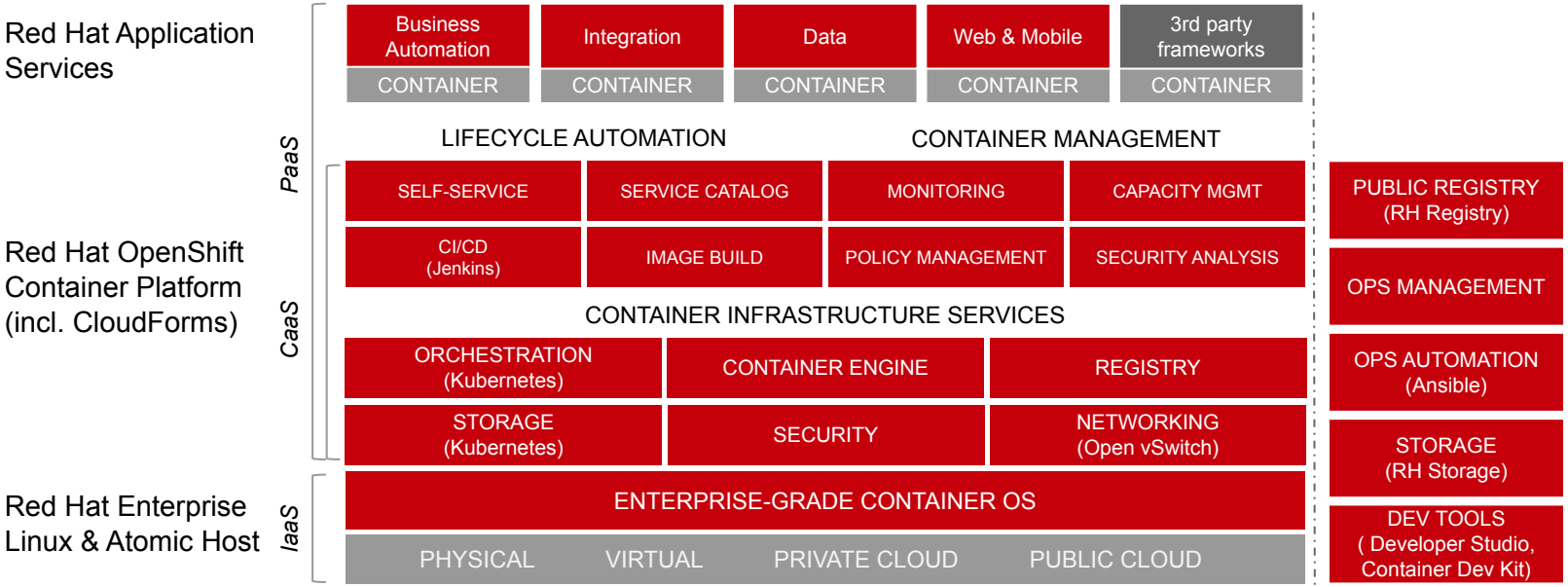
What is OpenShift?


Self-Service
Multi-language
Automation
Collaboration
Multi-tenant
RED HAT
OPENSHIFT
Standards-based
Web-scale
Open Source
Enterprise Grade
Secure

Red Hat

OPENSHIFT IS ENTERPRISE KUBERNETES

Red Hat makes building application with containers easy



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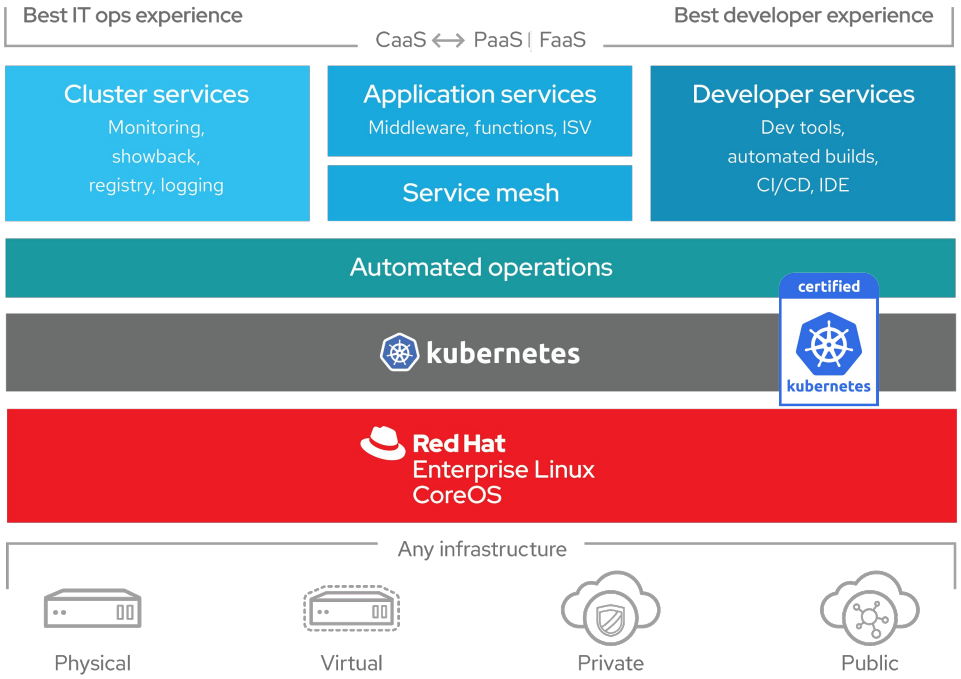
OpenShift 4 - A smarter Kubernetes platform



Automated, full-stack installation from the container host to application services

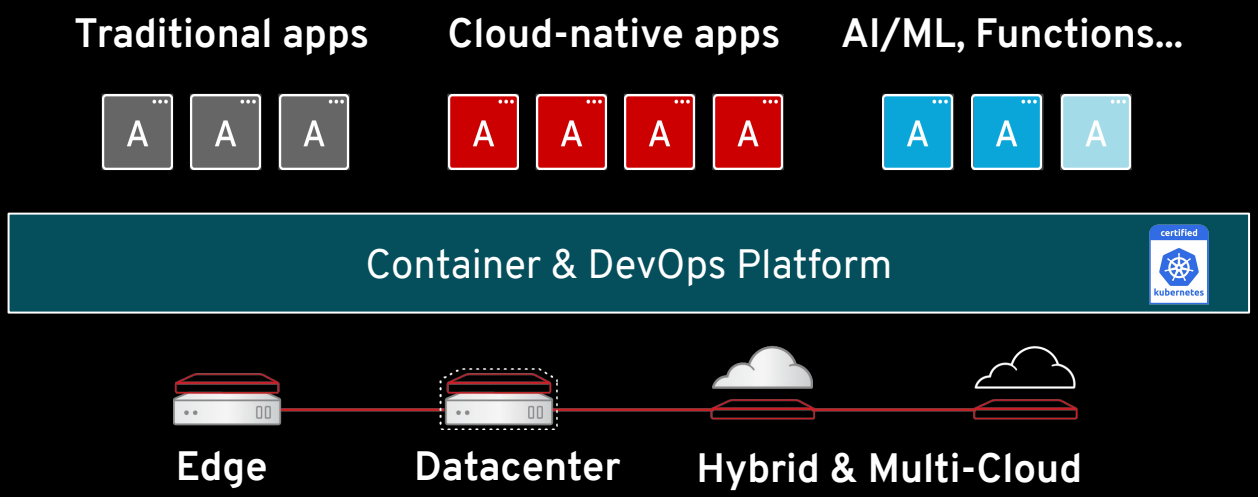
Seamless Kubernetes deployment to any cloud or on-premises environment

Autoscaling of cloud resources

One-click updates for platform, services, and applications

Red Hat

With OpenShift you can deliver all your applications in a whole new way



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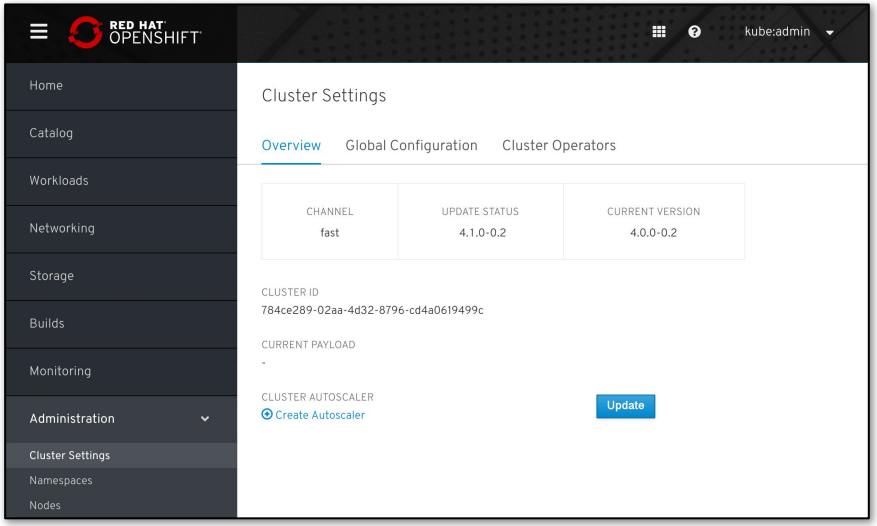
Over the Air (OTA) Updates

- OpenShift retrieves the list of available updates
- Admin selects the target version
- OpenShift is updated over the air
- Auto-update support



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Comprehensive container security

CONTROL
Application security

- Container content
- CI/CD pipeline
- Container registry
- Deployment policies

DEFEND
Infrastructure

- Container platform
- Container host multi-tenancy
- Network isolation
- Storage
- Audit & logging
- API management

EXTEND

- Security ecosystem

Red Hat

A consistent container application platform

FROM YOUR DATACENTER TO THE CLOUD

Automated operations

Multi-tenant

Secure by default

Network traffic control

Over-the-air updates

Monitoring & chargeback

Pluggable architecture

RED HAT® OPENSHIFT

Bare metal, VMware vSphere, Red Hat Virtualization, Red Hat OpenStack Platform, Amazon Web Services, Microsoft Azure, Google

Red Hat

Kubernetes adoption phases

1. Stateless apps

ReplicaSets

Deployments

2. Stateful apps

StatefulSets

Storage/CSI

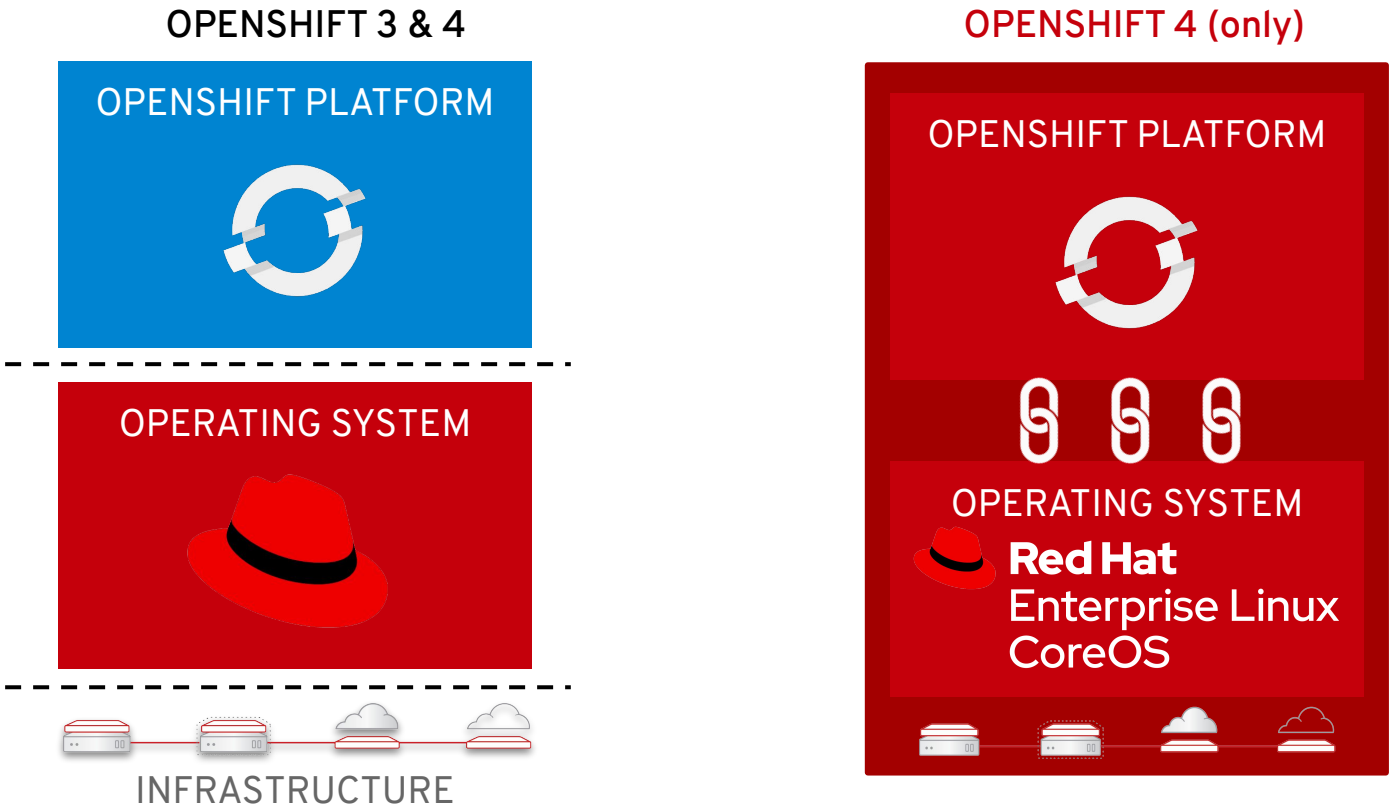
3. Distributed systems

Data rebalancing

Autoscaling

Seamless upgrades

Full-stack automated install



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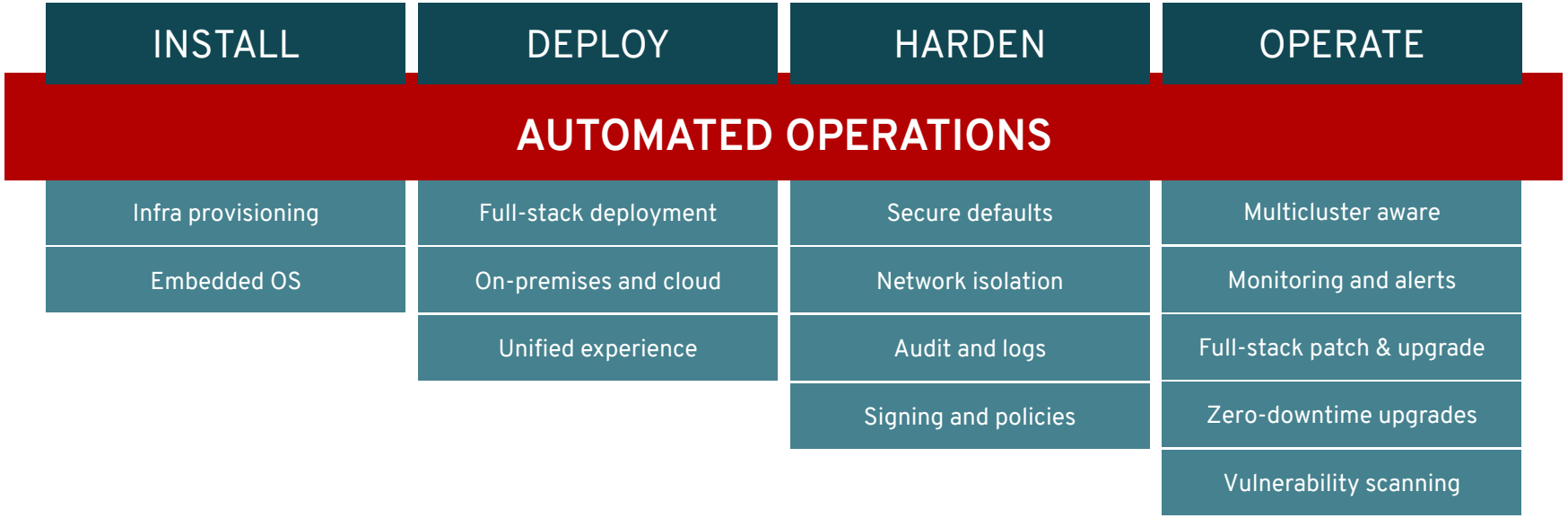
Automated container operations

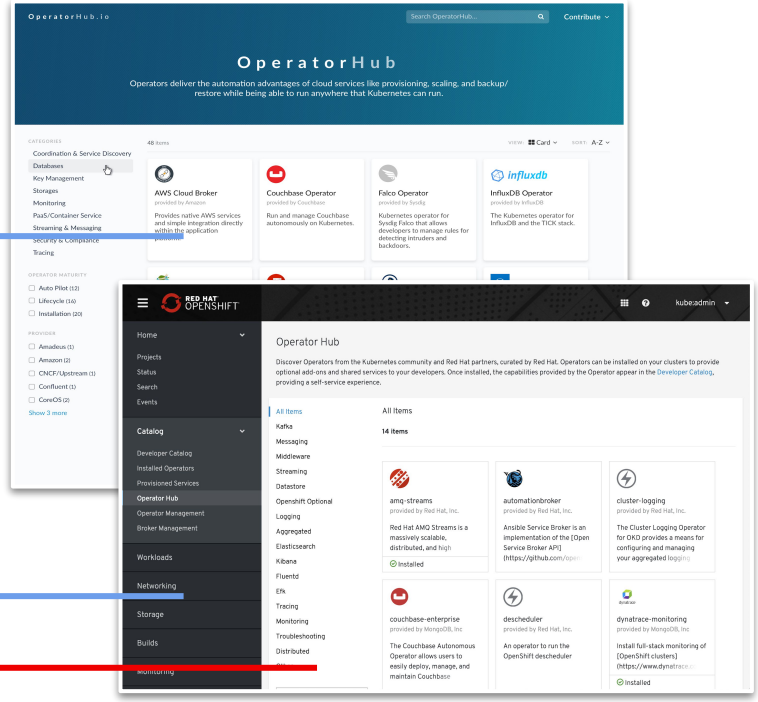
FULLY AUTOMATED DAY-1 AND DAY-2 OPERATIONS



Red Hat

OperatorHub and certified Operators

- OperatorHub.io launched by Red Hat, AWS, Microsoft and Google
- OpenShift Operator Certification
- OperatorHub integrated into OpenShift 4

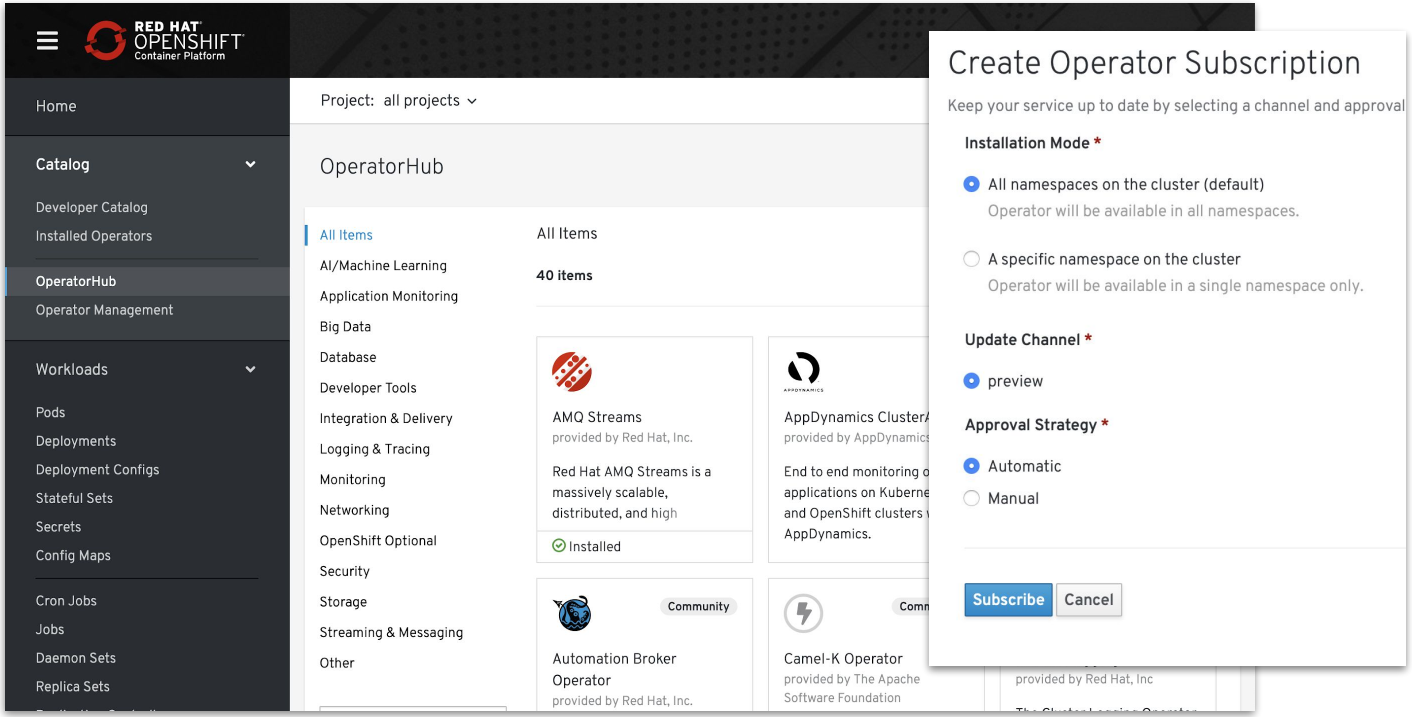


COMMUNITY OPERATORS

OPENSHIFT CERTIFIED OPERATORS

Red Hat

Full control for administrators



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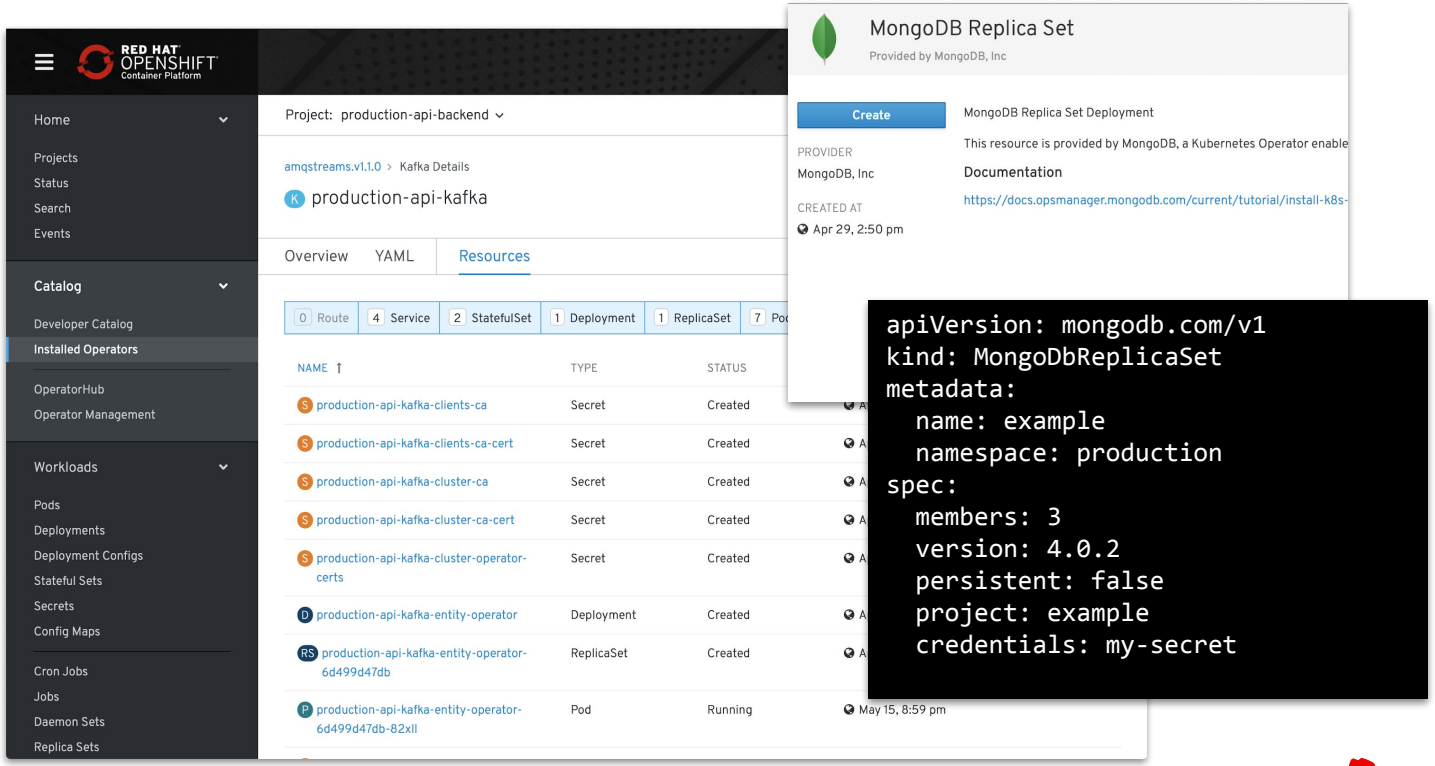
Self-service for developers



Red Hat

Getting Started with OpenShift for Developers

Hands-on Workshop

Presenter's Name
Title

Presenter's Name
Title

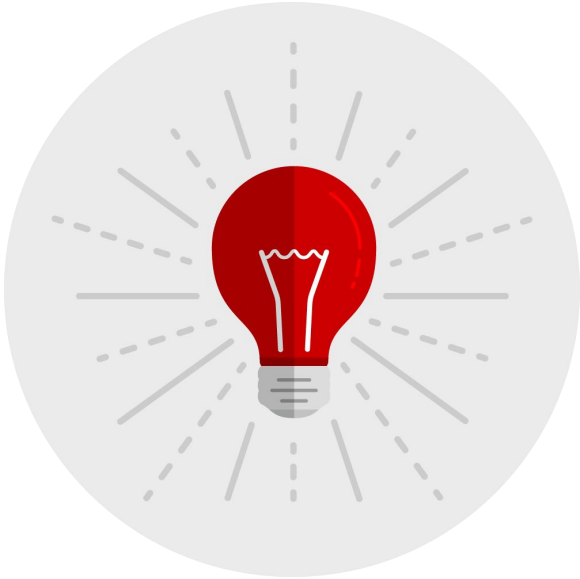
Red Hat

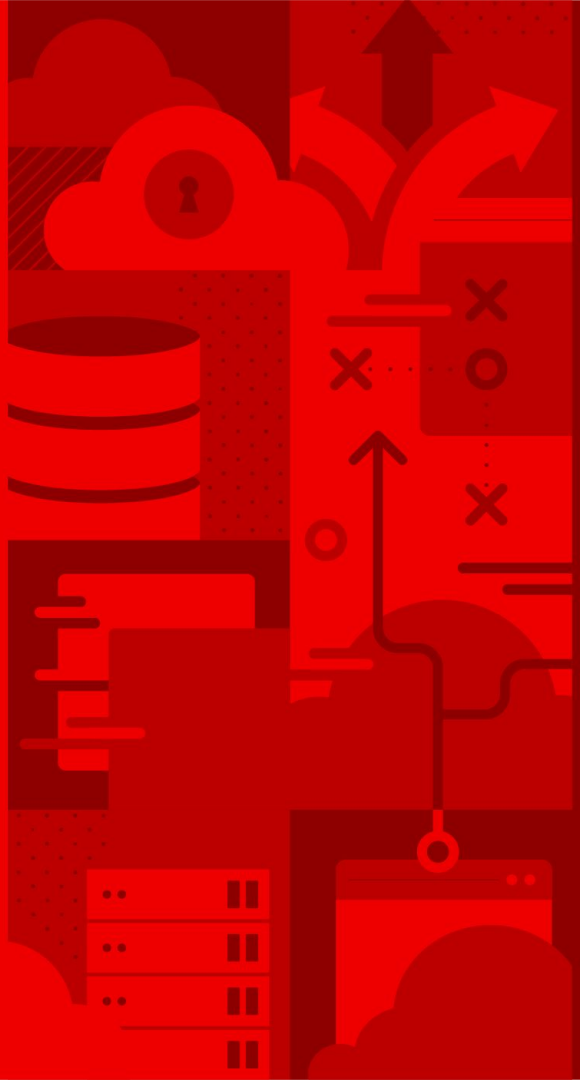
INTRODUCTION

AGENDA

09:00→ 11:00 <TMZ>

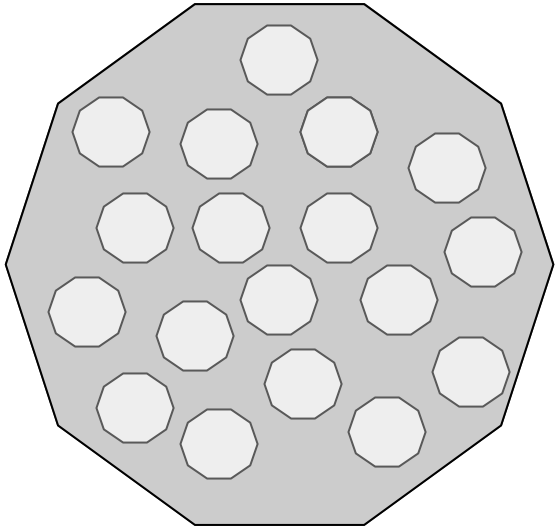
- Why Kubernetes?
- Container Technology
- What is Kubernetes
- Kubernetes Cluster
- Workshop Modules



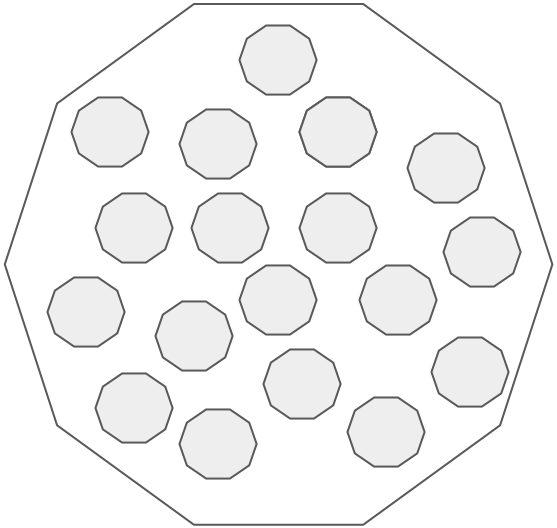


Why Kubernetes?

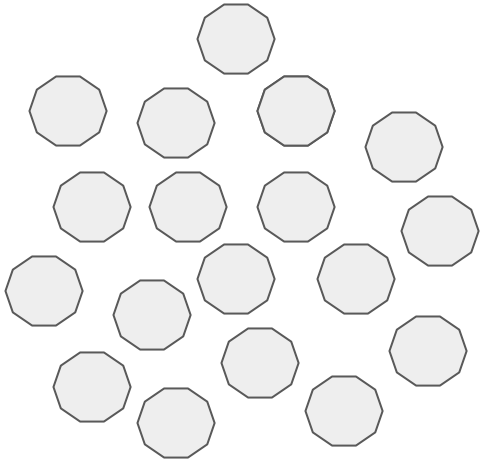
The Application



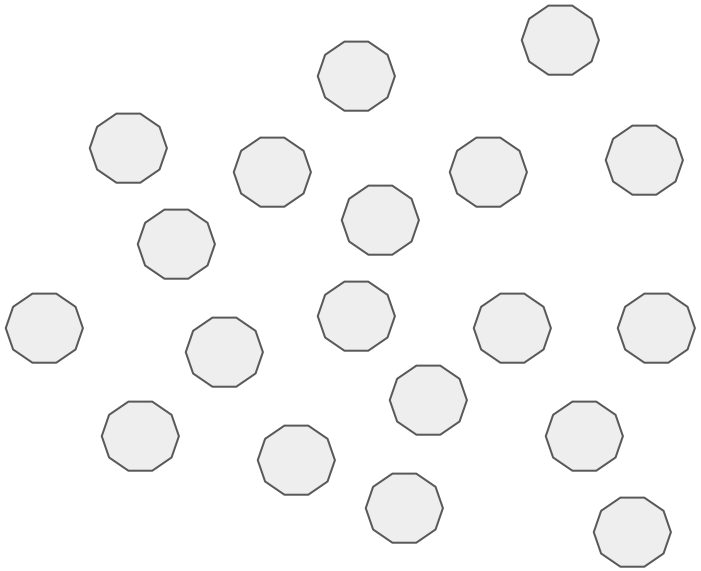
Modules



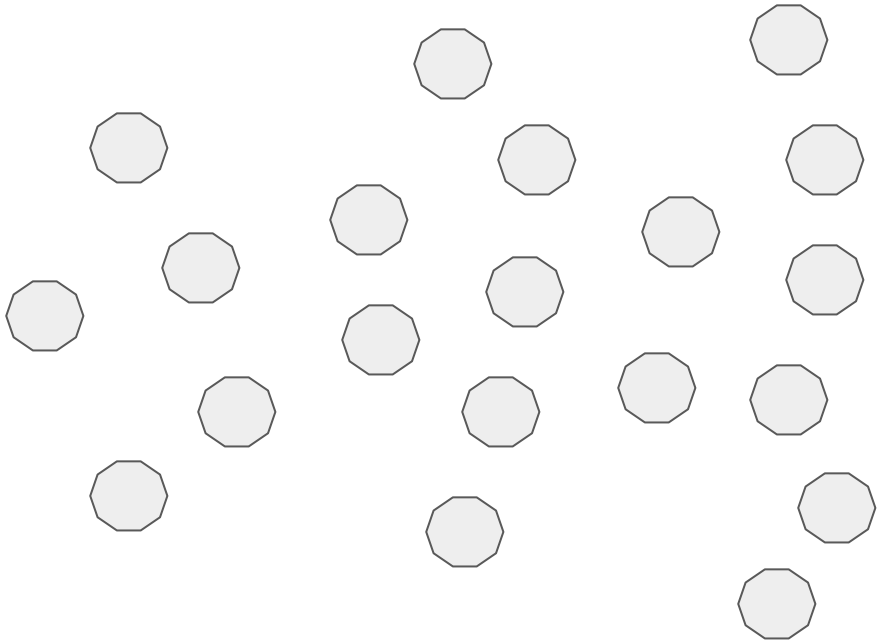
Microservices



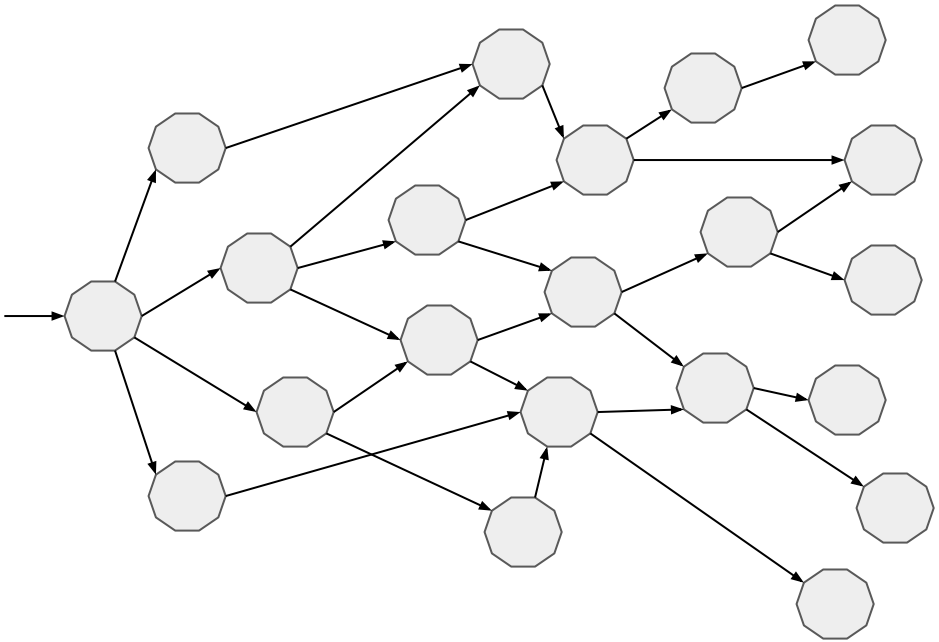
Microservices



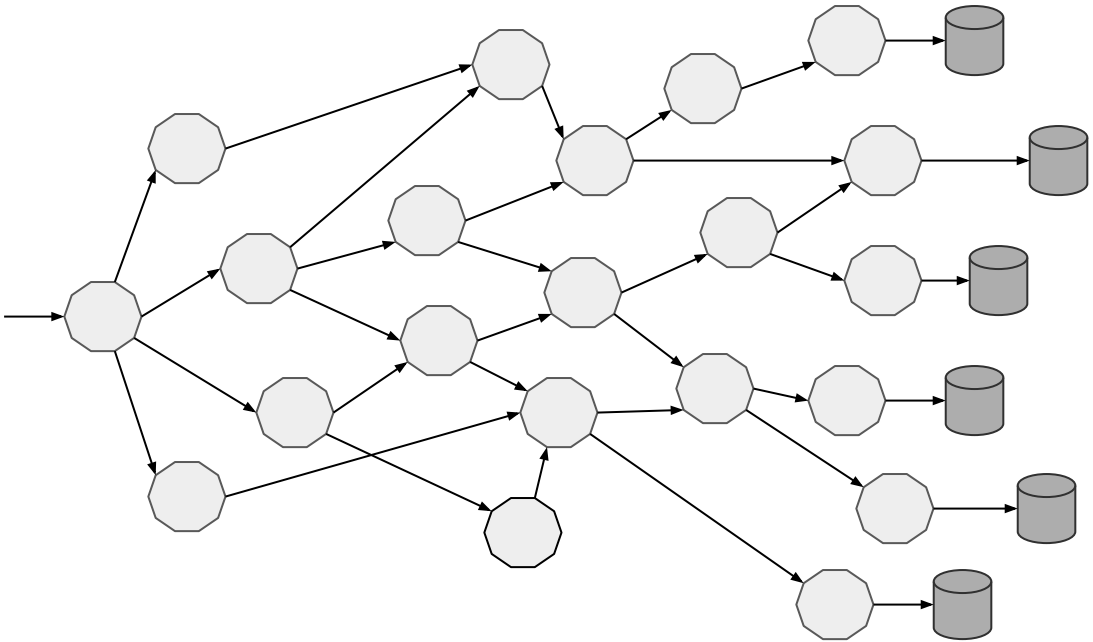
Microservices



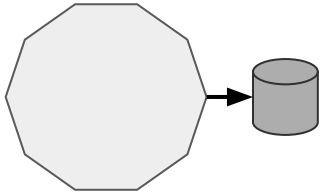
Network of Services



Microservices own their Data

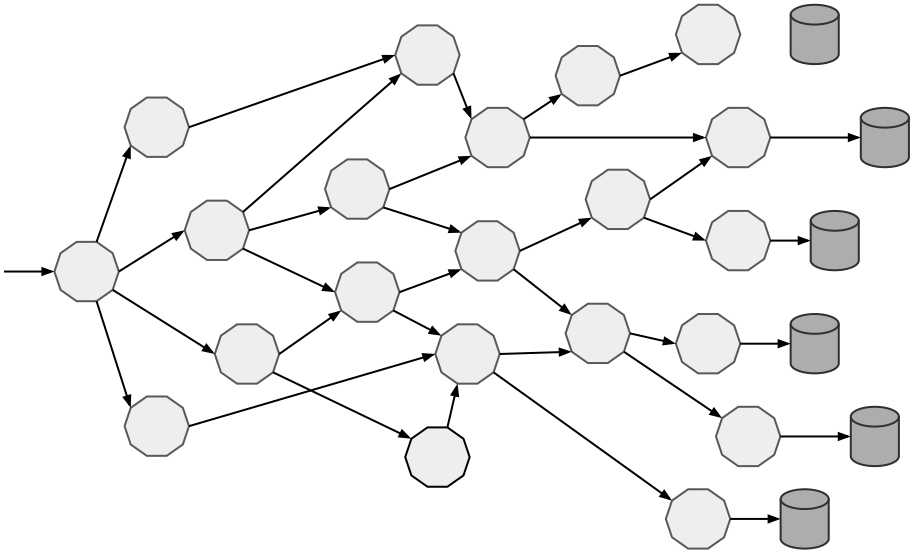


Old School



Love Thy Mono

New School



OPENSHIFT

Red Hat

Container Technology

Easy to scale up

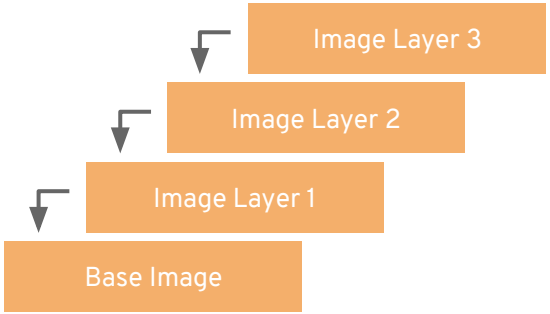
Mature technology

Supporting Modern Apps workloads and Cloud Native

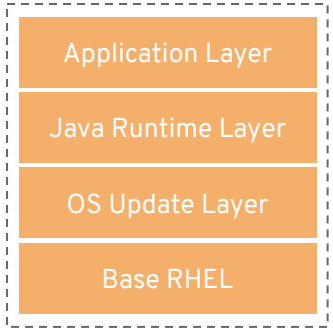
a container is the smallest compute unit

containers are created from container images

container images are structured in layers

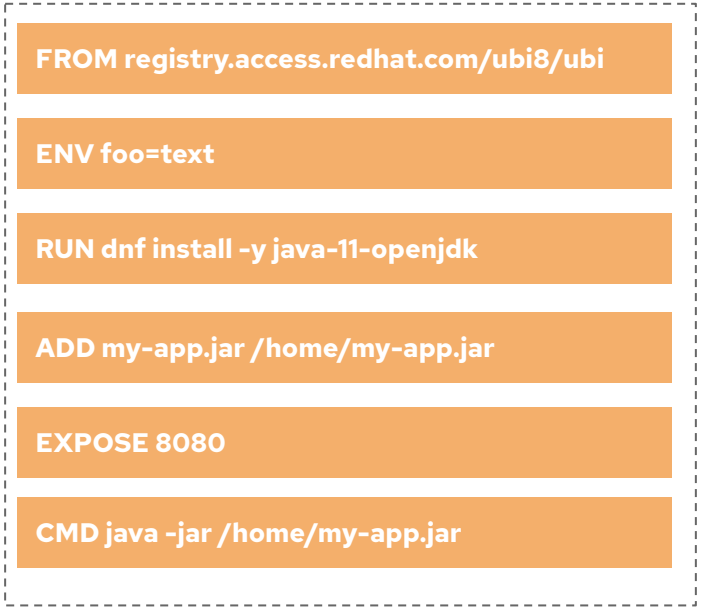


Container Image Layers



Example Container Image

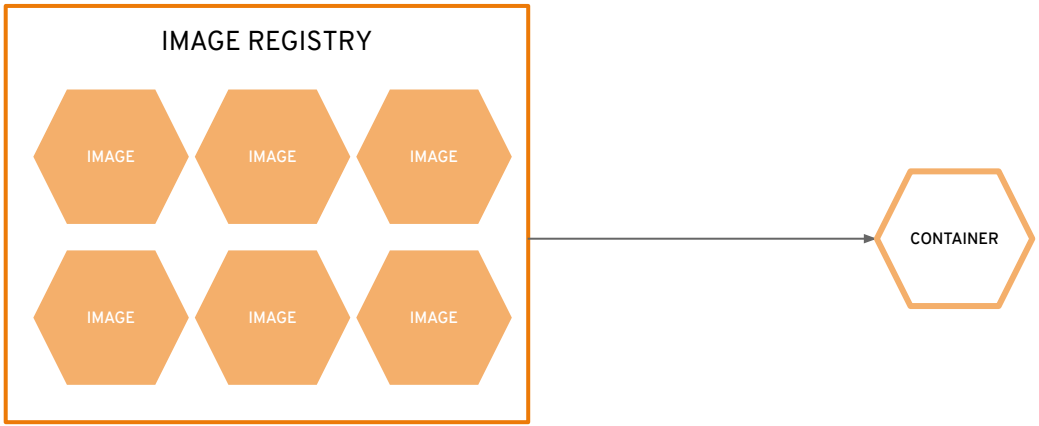
anatomy of a Dockerfile



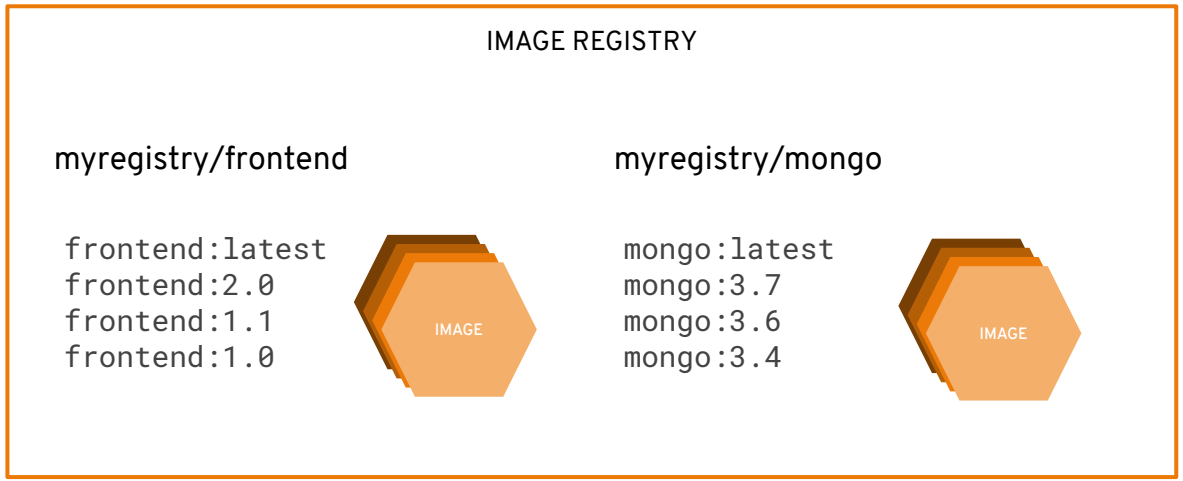
1. Inherit from a base image
2. Parameters as environment variables
3. Install dependencies (tooling from base image)
4. Add your app as a new Layer
5. Expose the port your app will use
6. Run the app

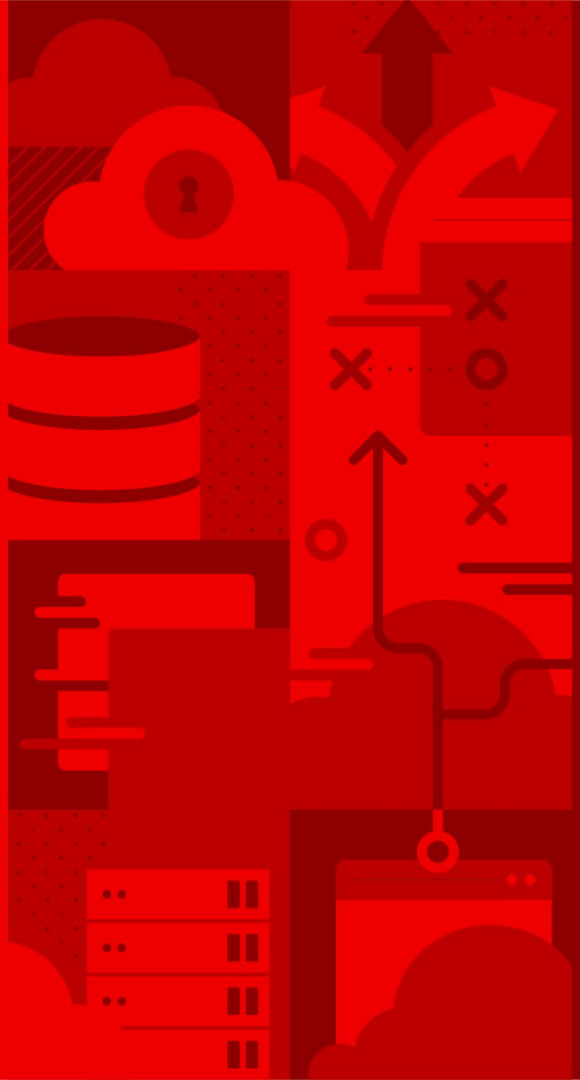
Example for Java app

container images are stored in an image registry



an image repository contains all versions of an image in the image registry



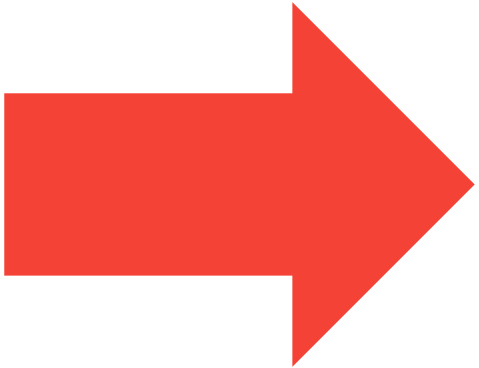


What is Kubernetes?

What is Kubernetes?

An open source orchestration system for managing containerized workloads across a cluster of nodes.

Understanding Kubernetes Objects



Kubernetes objects are persistent entities that represent the desired state of your cluster that you can manage with the K8s API

Understanding Kubernetes Objects

Pod

ReplicaSet

Deployment

Secret

Namespace

ConfigMap

Service

PersistentVolume

Kubernetes provides an API

API object primitives include these:

```
kind
apiVersion
metadata
spec
status
```

Node

- Node: a host machine where containerized workloads run
- Node activity is managed by one or more Master instances

Pod

- A group of one or more co-located containers
- Minimum unit of scale


```
kind: Pod
apiVersion: v1
metadata:
  creationTimestamp:
  name: hello-k8s
  labels:
    run: hello-k8s
spec:
  containers:
  - name: hello-k8s
    image: jkleinert/nodejsint-workshop
    ports:
    - containerPort: 8080
    resources: {}
```

Pod

```
kubectl create -f
https://raw.githubusercontent.com/jankleinert/hello-workshop/master/pod.json
```

```
kubectl get pods
```

```
kubectl describe pod/hello-k8s
```

Service

- Acts as a single endpoint for a collection of replicated pods
- Like a load balancer

```
kind: Service
apiVersion: v1
metadata:
  name: hello-k8s
  creationTimestamp:
  labels:
    run: hello-k8s
spec:
  ports:
  - protocol: TCP
    port: 8080
    targetPort: 8080
  selector:
    run: hello-k8s
  type: NodePort
status:
  loadBalancer: {}
```

Service

```
kubectl expose pod/hello-k8s --port 8080 --type=NodePort
```

```
kubectl get svc/hello-k8s -o yaml
```

```
curl hello-k8s.<userX>:8080
```

Clean up

```
kubectl get pods -l run=hello-k8s
```

```
kubectl delete pods -l run=hello-k8s
```

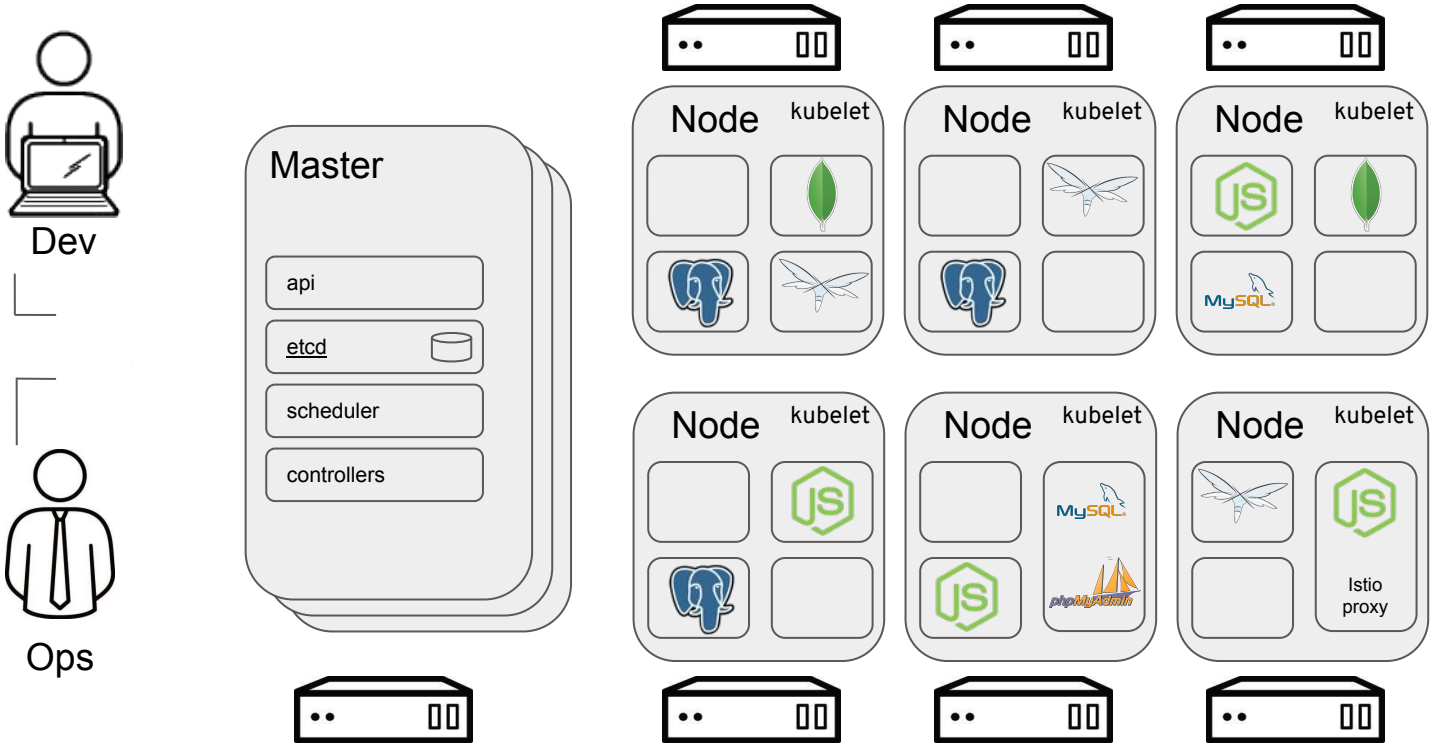
```
kubectl delete service hello-k8s
```

Deployment

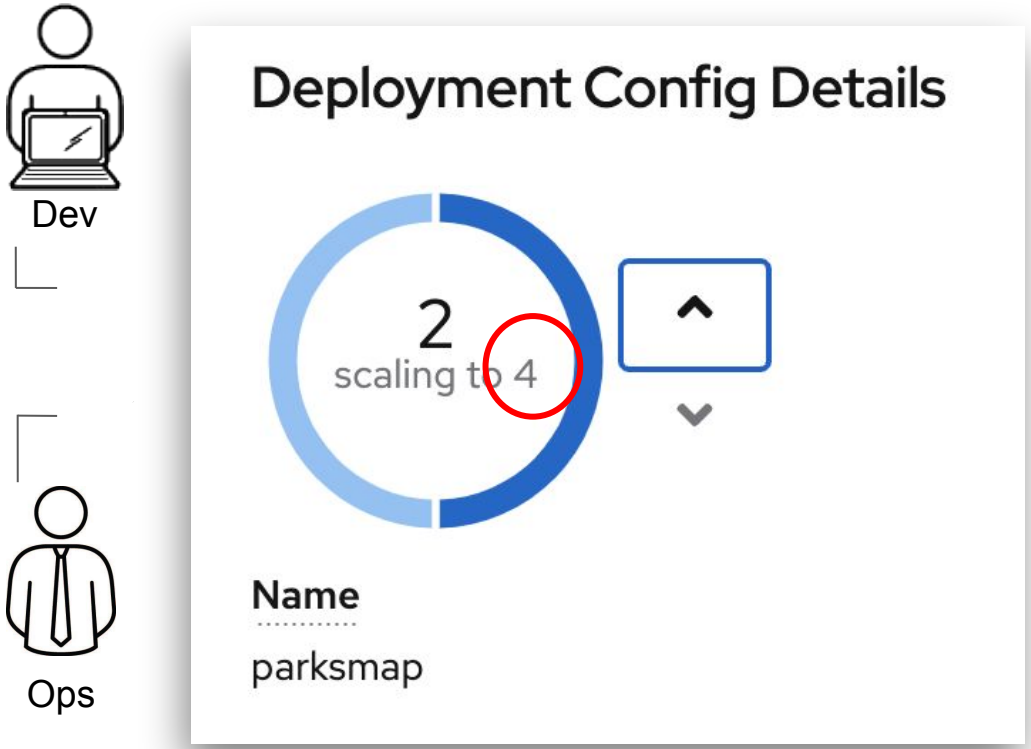
- Helps you specify container runtime, in terms of pods


```
kind: Deployment
apiVersion: apps/v1
metadata:
  name: hello-k8s
  creationTimestamp:
  labels:
    run: hello-k8s
spec:
  replicas: 1
  selector:
    matchLabels:
      run: hello-k8s
  template:
    metadata:
      creationTimestamp:
      labels:
        run: hello-k8s
    spec:
      containers:
      - name: hello-k8s
        image: jkleinert/nodejsint-workshop
        resources: {}
  strategy: {}
status: {}
```

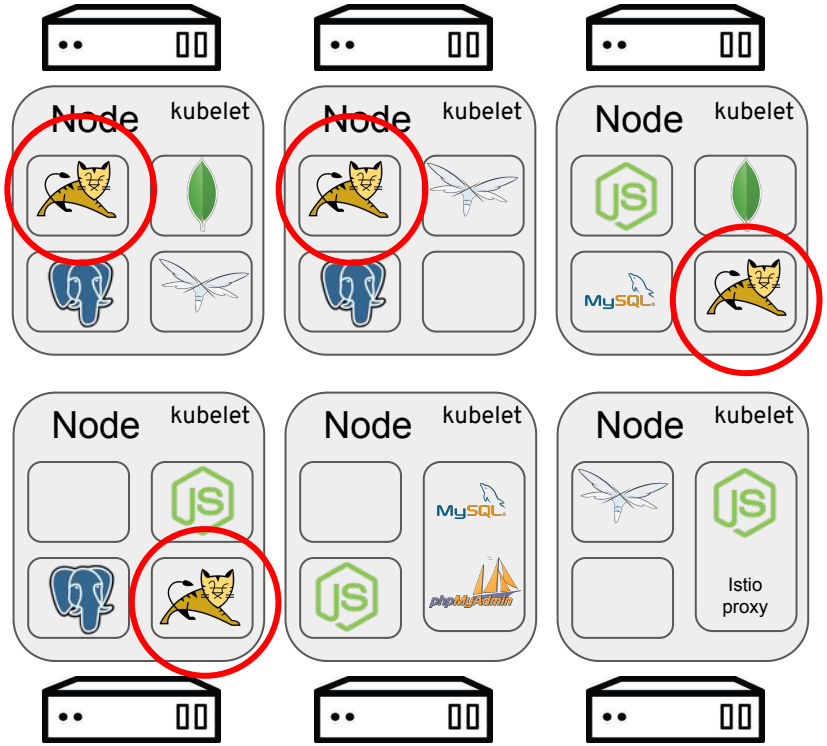
Kubernetes Cluster - Nodes



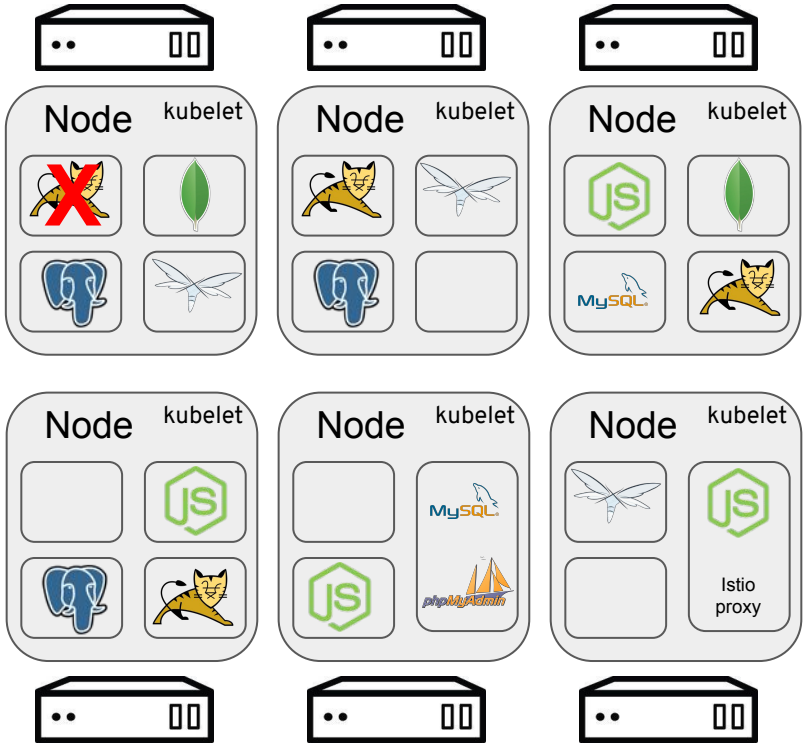
Kubernetes Cluster - Declarative



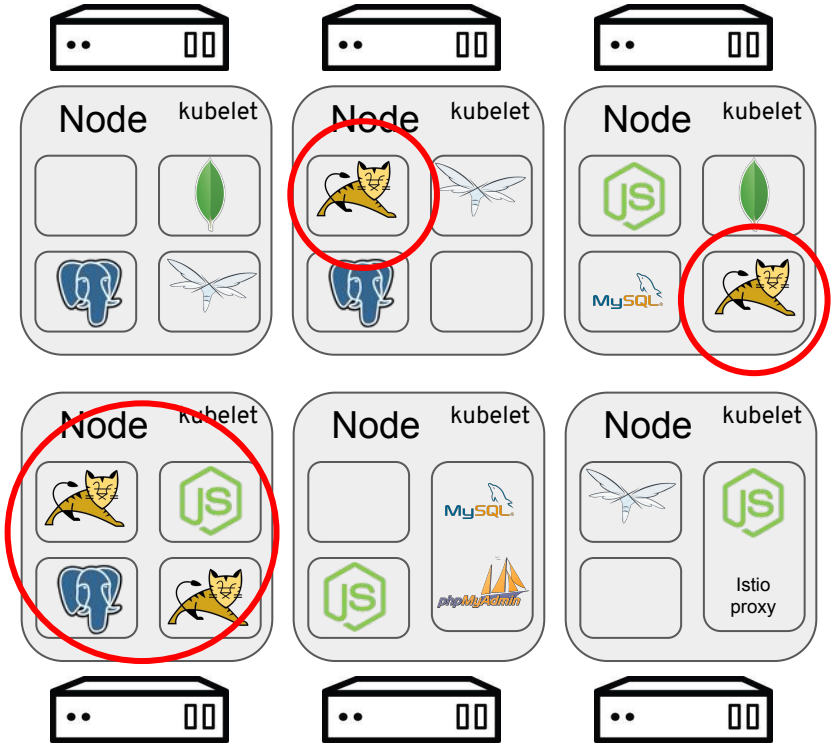
Kubernetes Cluster - 4 Tomcats



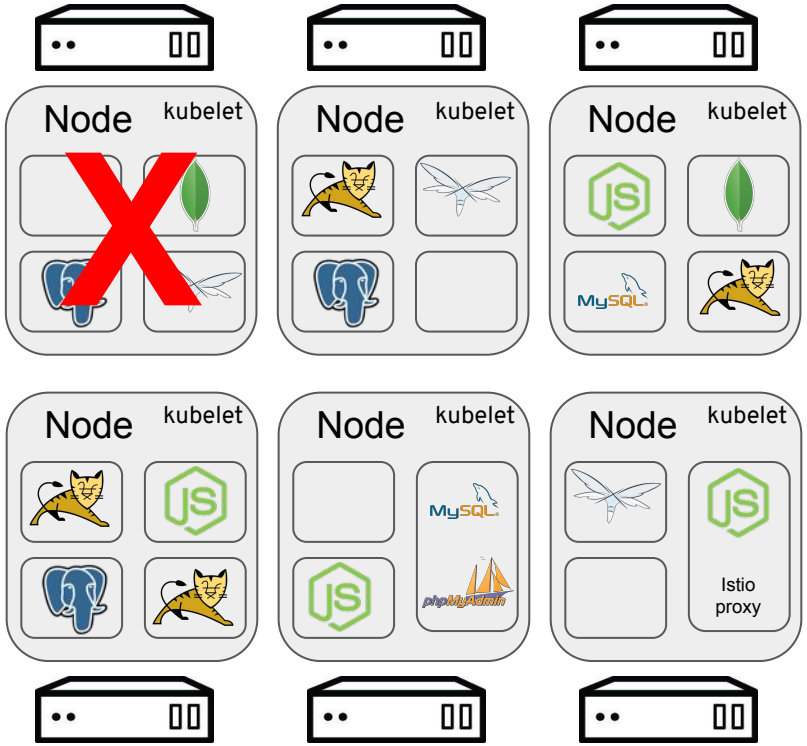
Kubernetes Cluster - Pod Fail



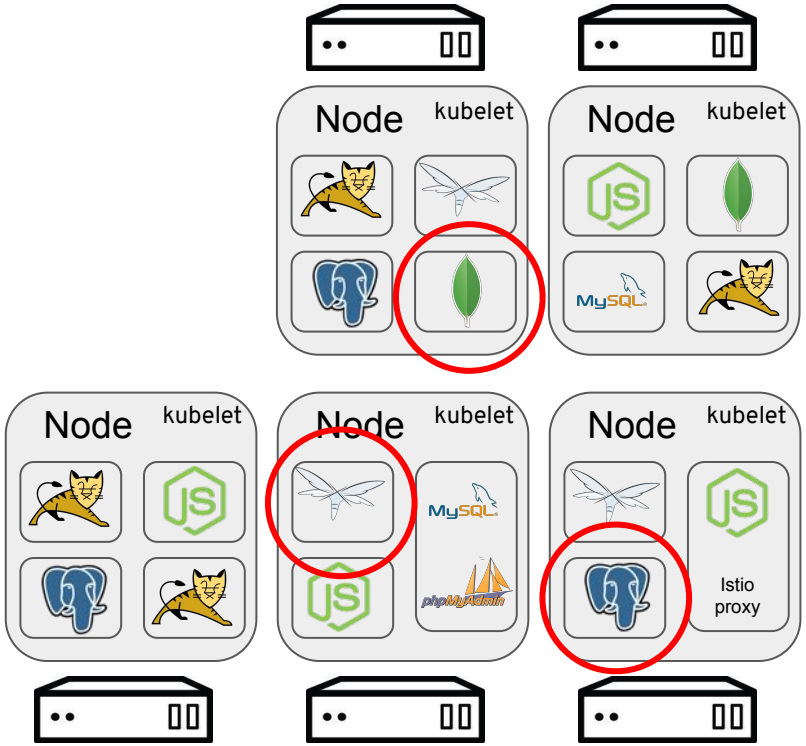
Kubernetes Cluster - Correcting

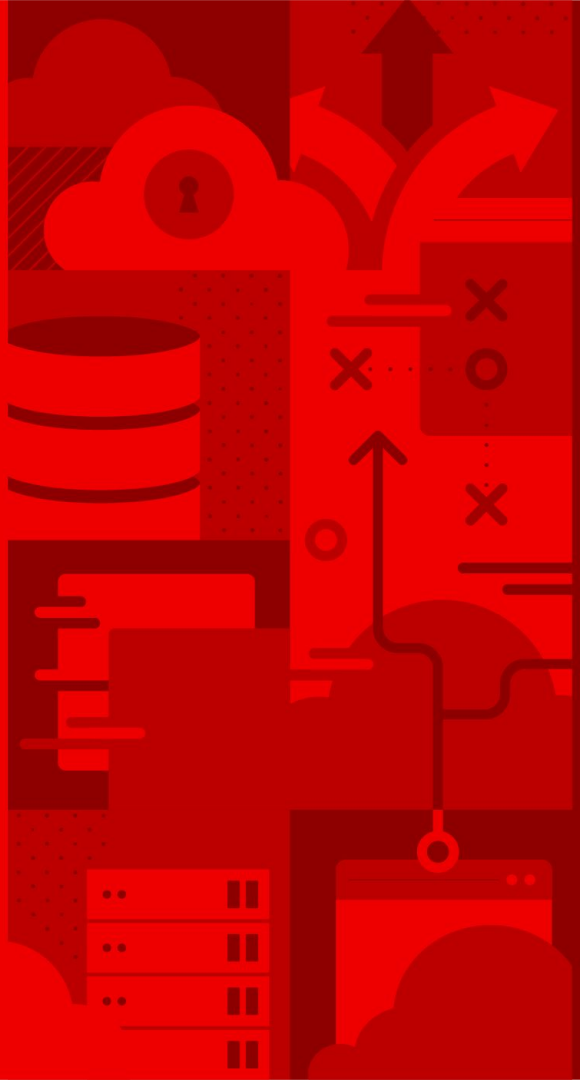


Kubernetes Cluster - Node Fail



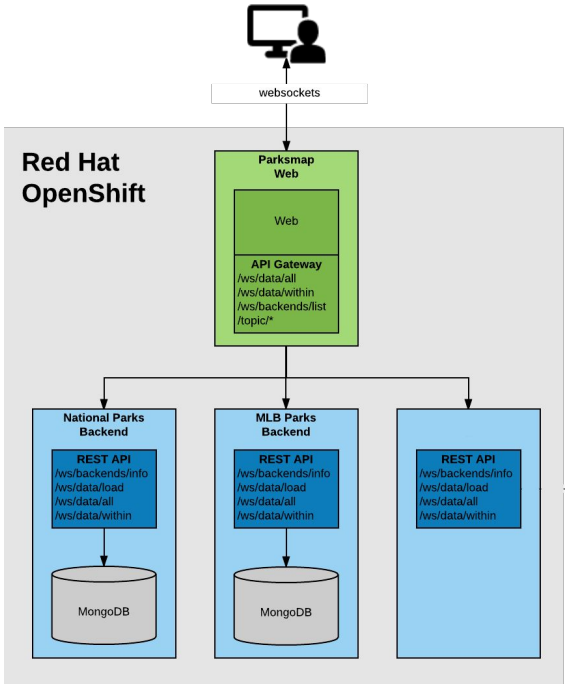
Kubernetes Cluster - Pods Replaced





OpenShift Demonstrations

Parksmap Architecture



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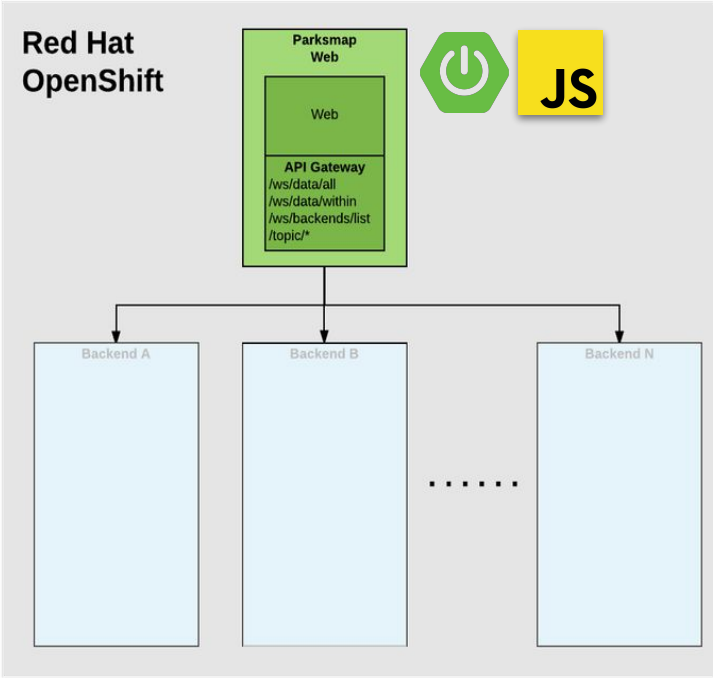
Parksmap Web

- Spring boot frontend using Mapbox Javascript API to display a World map with data points
- Provided as Container Image available publicly from Quay.io
- Interacts with different backends exposing same REST endpoints (can integrate an API Gateway)
- Your First App deployment from OpenShift Developer Console



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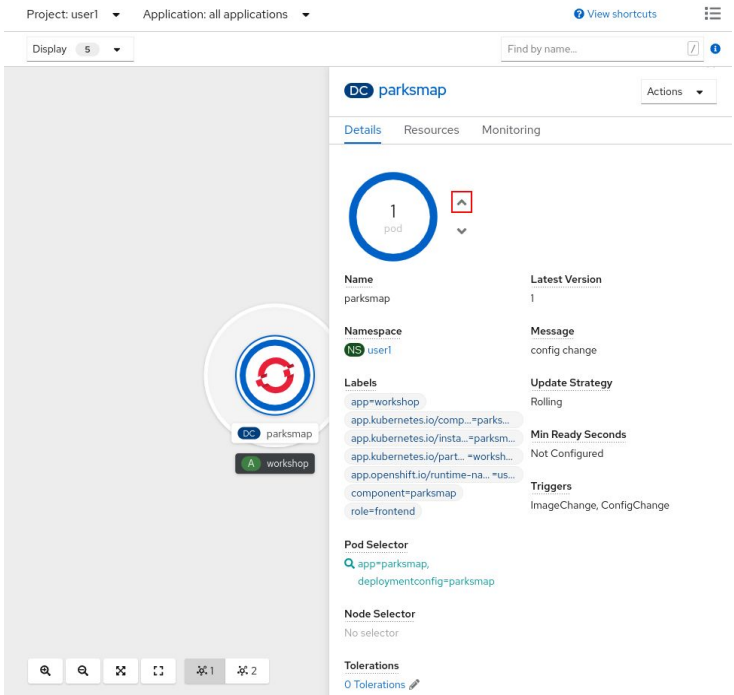
Parksmap: Exploring OpenShift

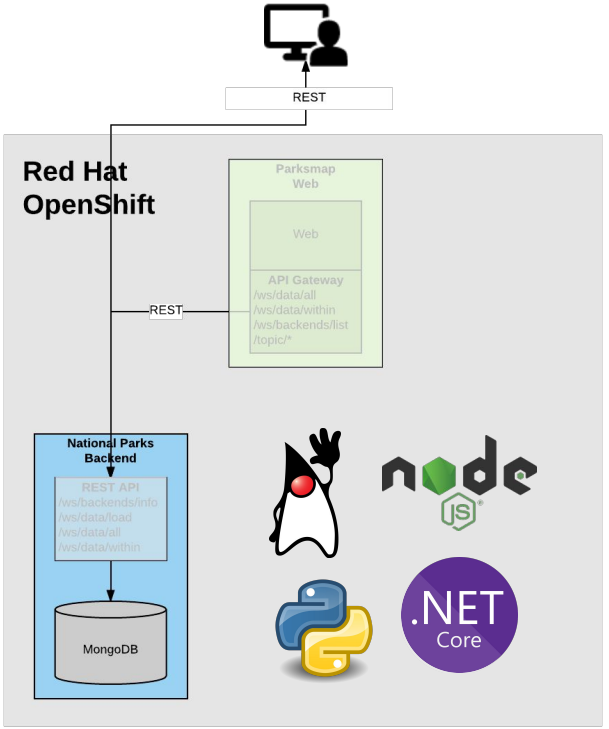


- Scaling Apps
- Logging
- Labels
- Permissions
- Accessing and debugging Containers

Red Hat

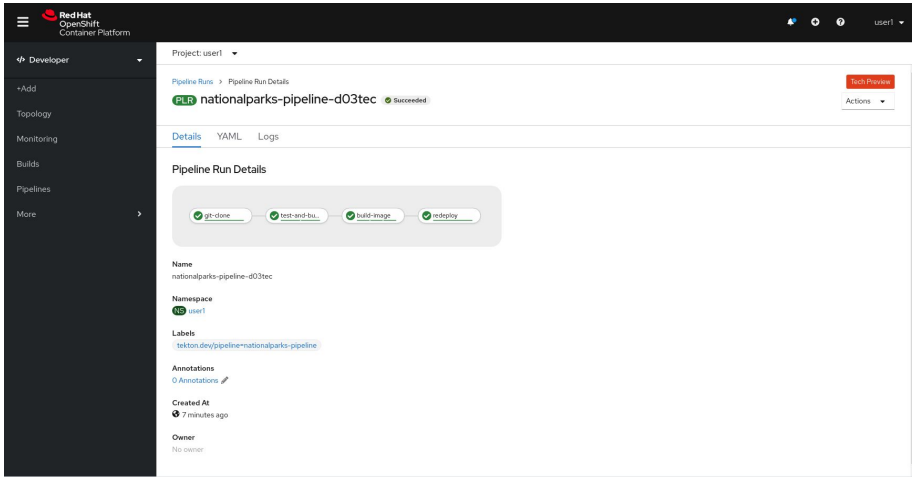
NationalParks Backend

- Backend to show worldwide National Parks
- Using MongoDB Database to save and retrieve data as geo locations
- Exposes REST APIs for Parksmap frontend
- Create Container Image automatically from source code using S2I (Source-to-Image)
- Available for Java, NodeJS, Python and .NET Core

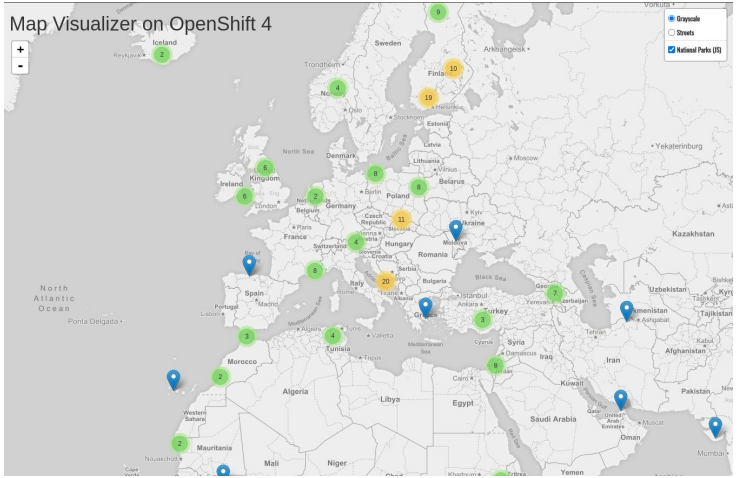


Red Hat

NationalParks: Exploring OpenShift



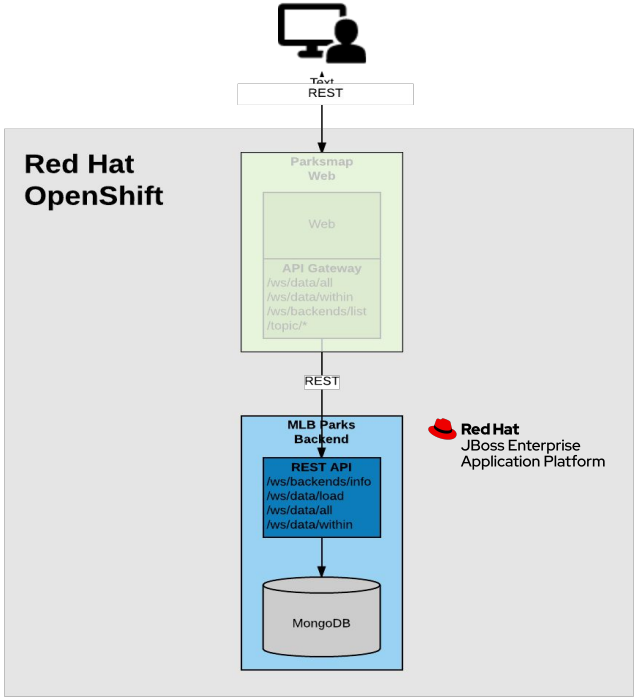
- Health Checks
- Automation with Pipelines
- Web Hooks to build and deploy automatically from code changes



Red Hat

MLB Parks Backend (Java)

- OpenShift runs nicely also “legacy” apps
- Java EE backend to show Major League Baseball Stadiums in North America
- Build artifacts (.war) locally with your IDE or workstation
- Create and deploy Container Image to OpenShift with S2I Binary Builds



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Red Hat OpenShift Training

Start here - Introduction to OpenShift

DO180	Red Hat OpenShift I: Containers & Kubernetes
EX180	Red Hat Certified Specialist in Containers and Kubernetes

Administrator Track

DO280	Red Hat OpenShift Administration II: Operating a Production Kubernetes Cluster
EX280	Red Hat Certified Specialist in OpenShift Administration
DO322	Red Hat OpenShift Installation Lab
DO380	Red Hat OpenShift Administration III: Scaling Kubernetes Deployments in the Enterprise

Developer Track

DO288	Red Hat OpenShift Development II: Containerizing Applications
EX288	Red Hat Certified Specialist in OpenShift Application Development
DO378	Red Hat Cloud-native Microservices Development with Quarkus
DO328	Building Resilient Microservices with Istio and Red Hat Service Mesh
AD421	Camel Integration and Development with Red Hat Fuse on OpenShift

DevSecOps Track

DO425	Red Hat Security: Securing Containers and OpenShift
EX425	Red Hat Certified Specialist in Security: Containers and OpenShift Container Platform

Prerequisite | Overview | Required Course | Suggested Exam | Complementary

Red Hat

Introduction to containers, Kubernetes, and OpenShift (DO180)

Learn to build and manage containers for deployment on a Kubernetes and Red Hat OpenShift cluster
Introduction to Containers, Kubernetes, and Red Hat OpenShift (DO180) helps you build core knowledge in managing containers through hands-on experience with containers, Kubernetes, and the Red Hat® OpenShift® Container Platform. These skills are needed for multiple roles, including developers, administrators, and site reliability engineers.

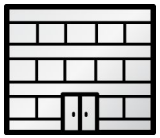
Topics covered include understanding container and OpenShift architecture, creating containerized services, and deploying applications on Kubernetes and Red Hat OpenShift.

Audience:

- Developers who wish to containerize software applications
- Administrators who are new to container technology and container orchestration
- Architects who are considering using container technologies in software architectures
- Site reliability engineers who are considering using Kubernetes and Red Hat OpenShift

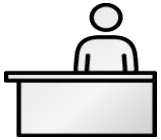
Prerequisites: Be able to use a Linux terminal session, issue operating system commands, and be familiar with shell scripting. Experience with web application architectures and their corresponding technologies is recommended, but not required.

WAYS TO TRAIN



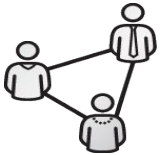
Onsite Training

Private On-site training and exams delivered at your location or at one of our training centers



Classroom Training

Training and test in a professional classroom environment led by Red Hat Certified Instructors



Virtual Training

Live instructor-led online training with the same high-quality, hands-on labs you'd find in our classrooms

Online Learning

90 days of access to course content and up to 80 hours of hands on labs – all available online, at your pace, and your schedule.

Red Hat Learning Subscription Evolution

Introducing a Premium subscription tier

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MODULARIZED VIRTUAL TRAINING

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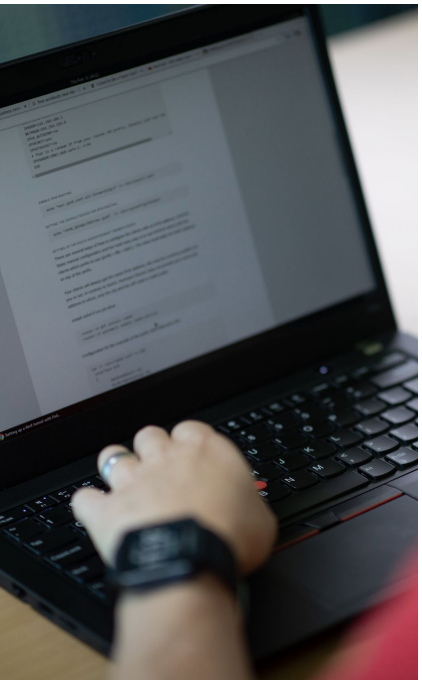
Red Hat Certification: Ways to test



Red Hat classroom exams

Classroom exams are scheduled exams that are publicly available and delivered in an IT classroom, typically to multiple examinees and monitored by an in-person proctor.

Red Hat onsite exams

Onsite exams are classroom exams delivered privately to an organization at its location or a location of its choosing.

Red Hat individual exams

Individual exams are exams for which examinees choose the date, time and place. Two different options exist, though not necessarily for all exams:

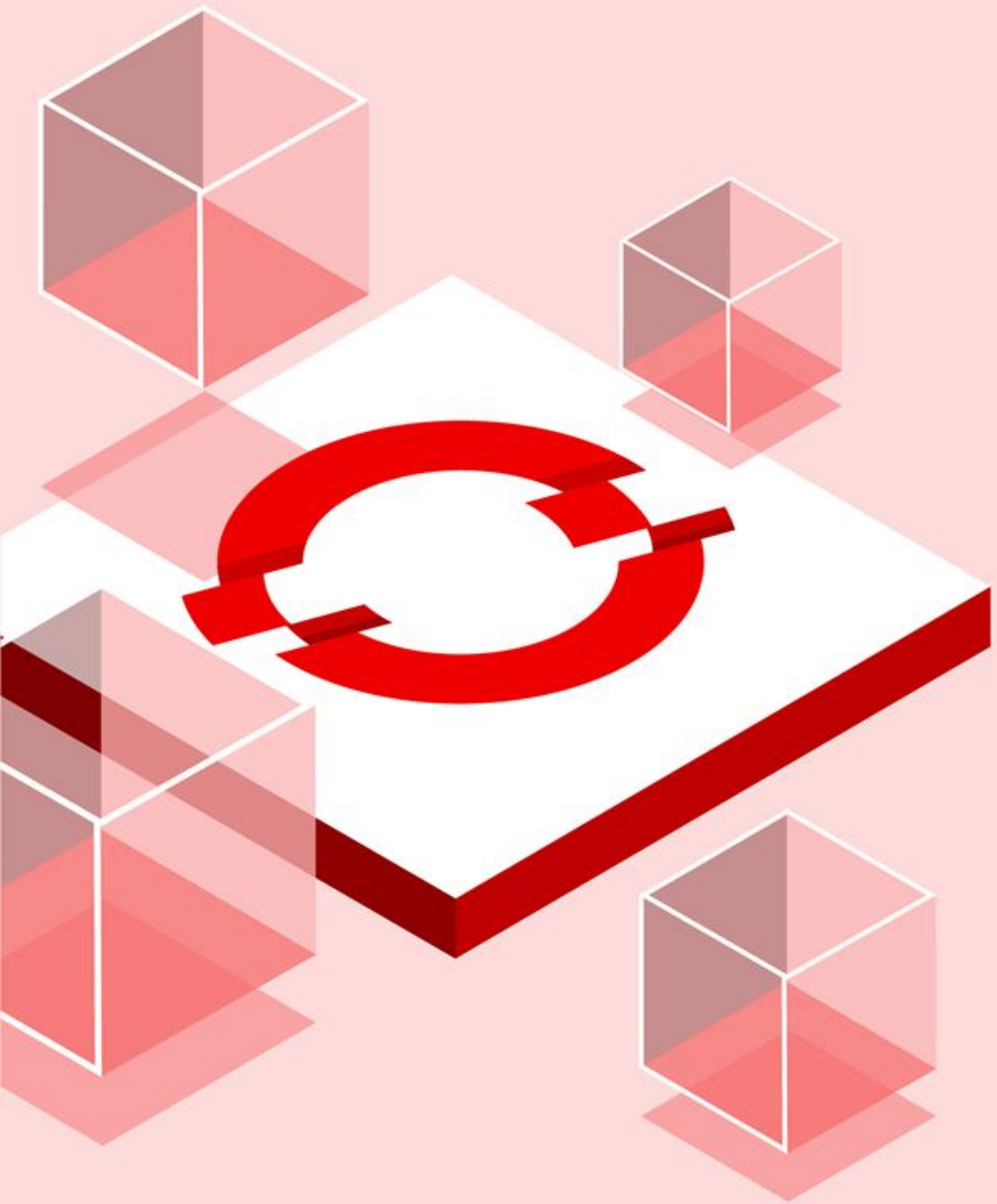
Red Hat testing center exams

Testing center exams are delivered in locations with a specially-configured exam system and for which candidates are observed by a remote proctor.

NEW: Red Hat remote exams

Remote exams are delivered online at your home, office or other location of your choice and observed by a remote proctor.

Q&A



Red Hat | carahsoft.

Thank you for attending!

Please contact us with questions.

Connor Murray

703-230-7583

877-RHAT-GOV (Team)

Connor.Murray@carahsoft.com

https://carah.io/redhatsled

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For additional resources:

carah.io/RedHatResources

For additional Red Hat solutions:

carah.io/RedHatPortfolio

To purchase, check out the contract vehicles available for procurement:

carah.io/RedHatContracts

For upcoming events:

carah.io/RedHatEvents

For additional Open Source solutions:

carah.io/OpenSourceSolutions

To set up a meeting:

redhat@carahsoft.com or 877-RHAT-GOV

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