

Red Hat OpenShift

MELBOURNE MEETUP
May 29 2019

A BIG THANK YOU TO OUR HOSTS

accenture >

High performance. Delivered.

Agenda

- OpenShift Commons and Summit Highlights
- Container Security Reference Architecture
- OpenShift 4 - The Automated Platform
- Quarkus - Supersonic Subatomic Java



OpenShift Commons and Summit Highlights



OPENSHIFT COMMONS @ RED HAT SUMMIT 2019

MONDAY, MAY 6th, 9:00-6:00 PM - WESTIN BOSTON WATERFRONT

CUSTOMER SPEAKERS:

- NASA Langley
- RBC/Nvidia
- UPS
- NGA / Ampsight
- Volkswagen
- Best Buy Canada
- Eli Lilly and Co
- THYSSEN KRUPP ELEVATORS

- Telco panel:
 - Optus, Deutsche Telekom, Bell Canada, Vodafone Turkey
- FSI panel:
 - Asiakastieto, Banco Hipotecario
 - Pending: RBS, CIBC

EVENT SITE: https://commons.openshift.org/gatherings/Boston_2019.html

EXPECTING 750 - 1,000 ATTENDEES

COMMONS REGISTRATION IS PART OF SUMMIT REGISTRATION

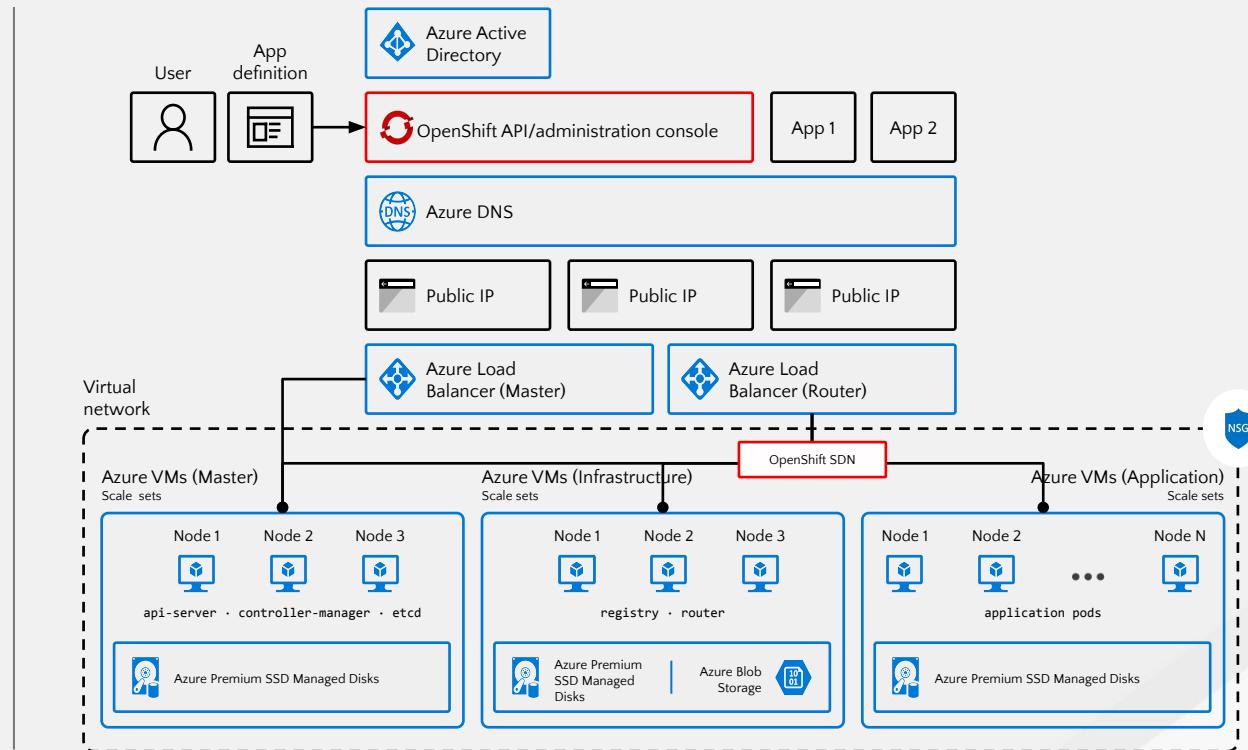


AZURE RED HAT OPENSOURCE LAUNCH



RUNNING YOUR OWN RED HAT OPENSHIFT CLUSTER

Responsibilities	
User management	Customer
Project and quota management	Customer
Application lifecycle	Customer
Cluster creation	Customer
Cluster management	Customer
Monitoring and logging	Customer
Network configuration	Customer
Software and security updates	Customer
Platform support	Microsoft and Red Hat



SIMPLIFY OPERATIONS WITH AZURE RED HAT OPENSHIFT

Responsibilities	
User management	
Project and quota management	
Application lifecycle	
Cluster creation	
Cluster management	
Monitoring and logging	
Network configuration	
Software and security updates	
Platform support	

Customer Microsoft and Red Hat



Let Microsoft and Red Hat...

Manage all your clusters

Monitor and operate your VMs

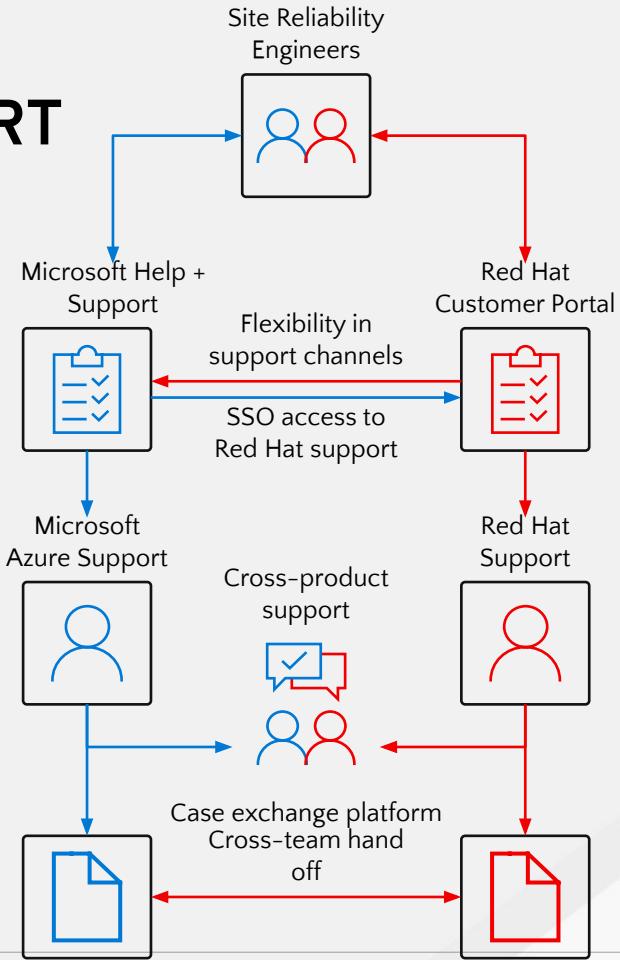
Secure your nodes

Manage environment patches

UNIFIED OPERATIONS AND SUPPORT

Jointly engineered, operated,
and supported by Microsoft
and Red Hat

- In-portal integrated support experience is available 24x7
- ISO 27001 compliant B2B communication channel
- Co-located support with Red Hat on-site team
- Integrated case systems
- Microsoft and Red Hat security response team collaboration





Trusted enterprise Kubernetes

- Trusted Host, Content, Platform
- Full Stack Automated Install
- Over the Air Updates & Day 2 Mgt

A cloud-like experience, everywhere

- Hybrid, Multi-Cluster Management
- Operator Framework
- Operator Hub & Certified ISVs

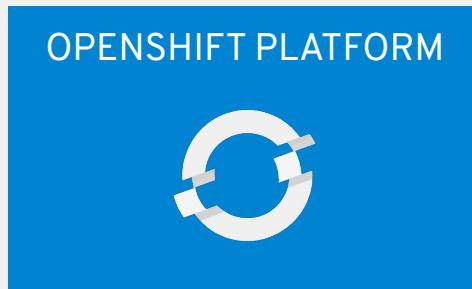
Empowering developers to innovate

- OpenShift Service Mesh (Istio)
- OpenShift Serverless (Knative)
- CodeReady Workspaces (Che)

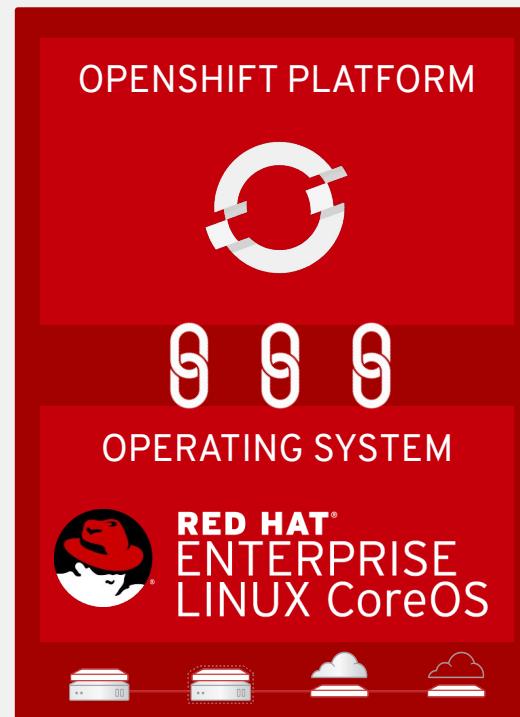


FULL STACK AUTOMATED INSTALL

OPENShift 3



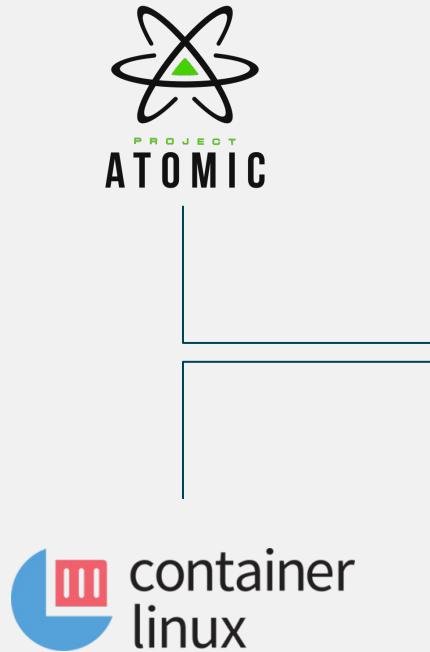
OPENSIFT 4



GENERAL DISTRIBUTION



RHEL COREOS



- Minimal Linux distribution
- Optimized for running containers
- Decreased attack surface
- Over-the-air automated updates
- Immutable foundation for OpenShift clusters
- Ignition-based Metal and Cloud host configuration



OVER-THE-AIR UPDATES

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

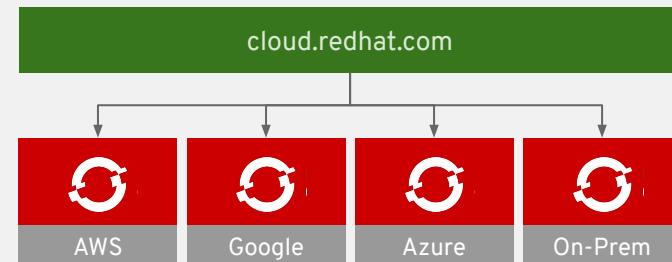
The screenshot shows the Red Hat OpenShift web interface. On the left, a dark sidebar menu includes Home, Catalog, Workloads, Networking, Storage, Builds, Monitoring, Administration (with sub-options Cluster Settings, Namespaces, and Nodes), and a user dropdown for 'kube:admin'. The main content area is titled 'Cluster Settings' and has tabs for Overview, Global Configuration, and Cluster Operators. Under 'Overview', it displays cluster information: CHANNEL fast, UPDATE STATUS 4.1.0-0.2, and CURRENT VERSION 4.0.0-0.2. It also shows the CLUSTER ID (784ce289-02aa-4d32-8796-cd4a0619499c) and CURRENT PAYLOAD (indicated by a minus sign). A 'Create Autoscaler' button and an 'Update' button are visible at the bottom.



UNIFIED HYBRID CLOUD

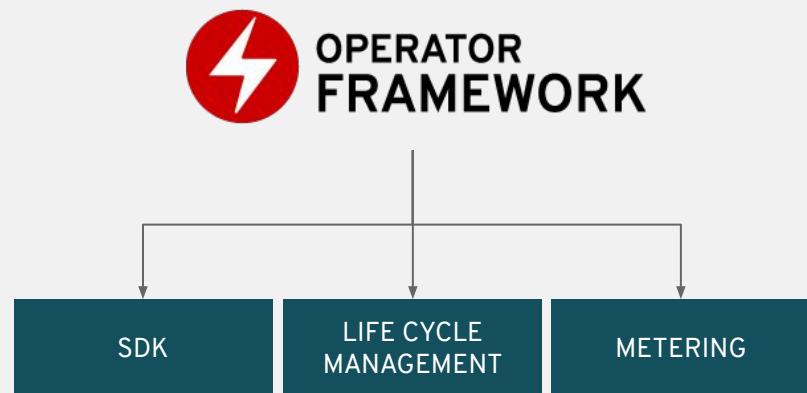
- Multi-cluster management
 - New clusters on AWS, Azure, Google, vSphere, OpenStack, and bare metal
 - Register existing clusters
 - Including OpenShift Dedicated
- Management operations
 - Install new clusters
 - View all registered clusters
 - Update clusters

The screenshot shows the 'Clusters' page of the OpenShift Cluster Manager. On the left, a sidebar includes 'Clusters', 'Subscriptions', 'Membership', and 'Administration'. The main area displays a table titled 'OpenShift Clusters' with columns for 'CLUSTER NAME', 'PLATFORM', 'VERSION', and 'MESSAGE'. Two entries are listed: 'Production' (AWS, 4.0.158, Security upgrade available) and 'Cloud Staging' (AWS, 4.0.163, Up to date). A 'Register cluster' button is visible at the top of the cluster list.



OPERATOR FRAMEWORK

Operators codify operational knowledge and workflows to automate life cycle management of containerized applications with Kubernetes



OPERATORHUB IN OPENShift 4

For Cluster Admins:

The screenshot shows the OperatorHub interface. On the left, there's a sidebar with categories like All Items, AI/Machine Learning, Big Data, Database, Integration & Delivery, Logging & Tracing, and Monitoring. The main area displays the AMQ Streams operator details. It includes a logo, the name "AMQ Streams", the version "1.1.0 provided by Red Hat, Inc.", and a large blue "Install" button. Below this, it says "OPERATOR VERSION 1.1.0" and "PROVIDER TYPE The core capability". There are also sections for Languages, Middleware, and Other. At the bottom, there are cards for "AMQ Streams" and "Aqua Security". A tooltip at the bottom left says "Red Hat AMQ Streams is a".

For Developers:

The screenshot shows the Developer Catalog interface. It has a sidebar with "Developer Catalog" and a note about adding shared apps, services, or source-to-image builders. The main area shows a search bar with "Kafka", a list of items with "6 items", and two cards for "Kafka" and "Kafka Connect". The "Kafka" card says "Represented a Kafka cluster". The "Kafka Connect" card says "Represented a Kafka Connect cluster". On the right, there's a detailed view of a Kafka cluster named "my-cluster" with tabs for Overview, YAML, and Resources. The Resources tab shows a table with one Route, four Services, two StatefulSets, one Deployment, and one ReplicaSet. The table includes columns for NAME, TYPE, and STATUS.

- Discovery/install/upgrade of Operators
- Community, Red Hat products, Certified ISVs
- Granular access via specific Projects

- Developers can't see admin screens
- Operator capabilities are exposed in Catalog
- Self-service management



CONTAINER TOOLS

OCI tooling to create, run, and manage, Linux Containers with a cluster-friendly life cycle



**Light-weight runtime
for the Kube CRI**

- OCI compliant and docker compatible
- CLI via crictl
- Improved performance and scalability
- Continue to track the Kube CRI



**Secure & flexible OCI
container builds**

- Integrated into OCP build pods
- Performance improvements for knative enablement
- Image signing improvements



**docker-compatible
CLI for containers**

- Remote management API via Varlink
- Image/container tagging
- Advanced namespace isolation



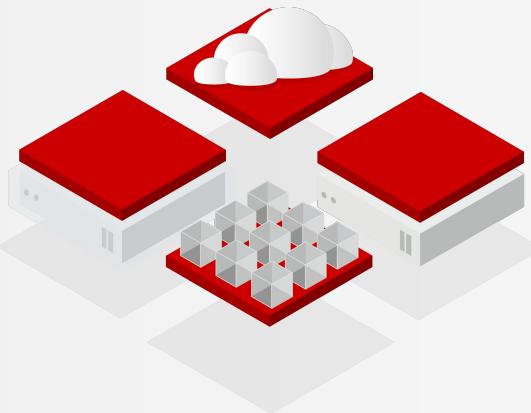
hello world

The intelligent OS **for your next big thing.**



RED HAT ENTERPRISE LINUX 8

Modern foundation for the datacenter, powering current and next-gen workloads



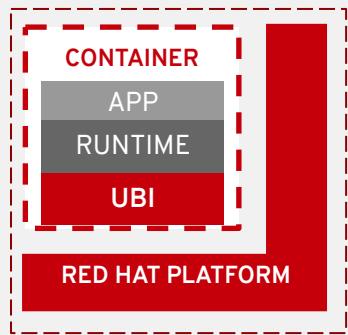
- ▶ **Core Components Snapshot**
4.18.x kernel
gcc 8.2, llvm 6.0
systemd 239
YUM 4 (DNF base)
- ▶ **Simplified repository layout**
BaseOS: Foundational components
AppStream: Additional user space components
- ▶ **Content Flexibility via Application Stream**
Perfectly embeds Software Collections & Extras content into RHEL
- ▶ **Enhanced security**
System-wide crypto policies

Available in OpenShift 4.1 for Worker Nodes

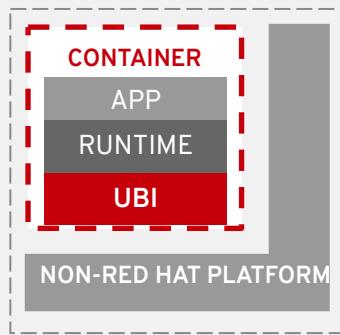


RED HAT UNIVERSAL BASE IMAGE (UBI)

The base image for all of your needs on: OpenShift, RHEL, or other platform of choice



Fully supported by Red Hat



Supported by end user

The Red Hat Universal Base Image is a freely useable and redistributable container image packed with all of the value of Red Hat Enterprise Linux

Development

- Minimal footprint
- Latest programming languages
- Makes ops happy

Production

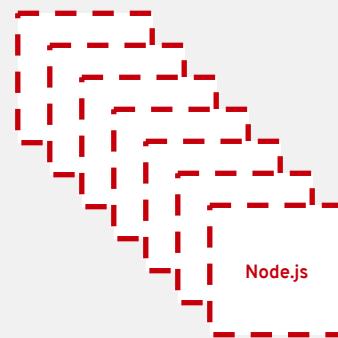
- Performance
- Security
- Life cycle

[Detailed Presentation](#)



Red Hat Universal Base Image

Enable an ecosystem of freely distributable operators for Kubernetes/OpenShift



Base
Images

Pre-Built
Language
Images

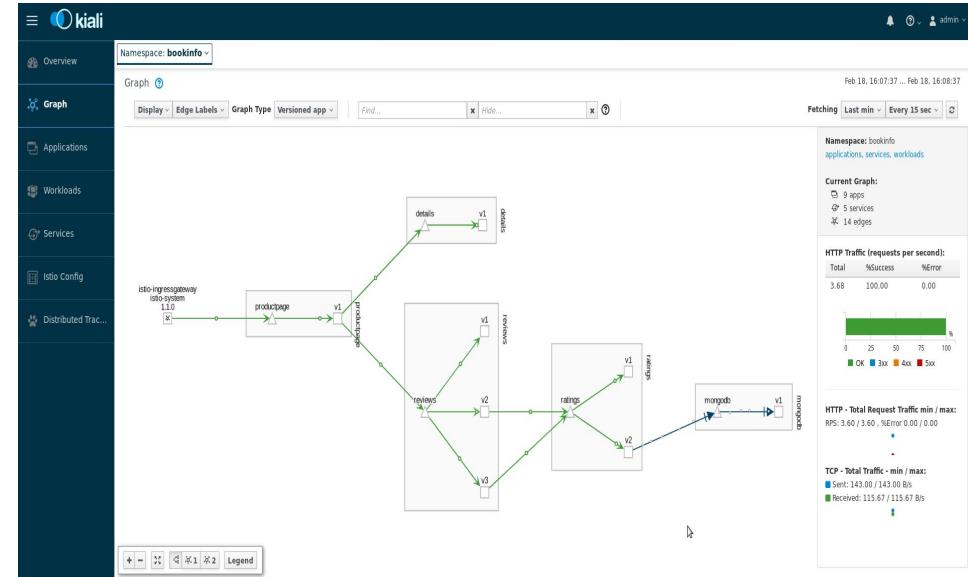


Package
Subset

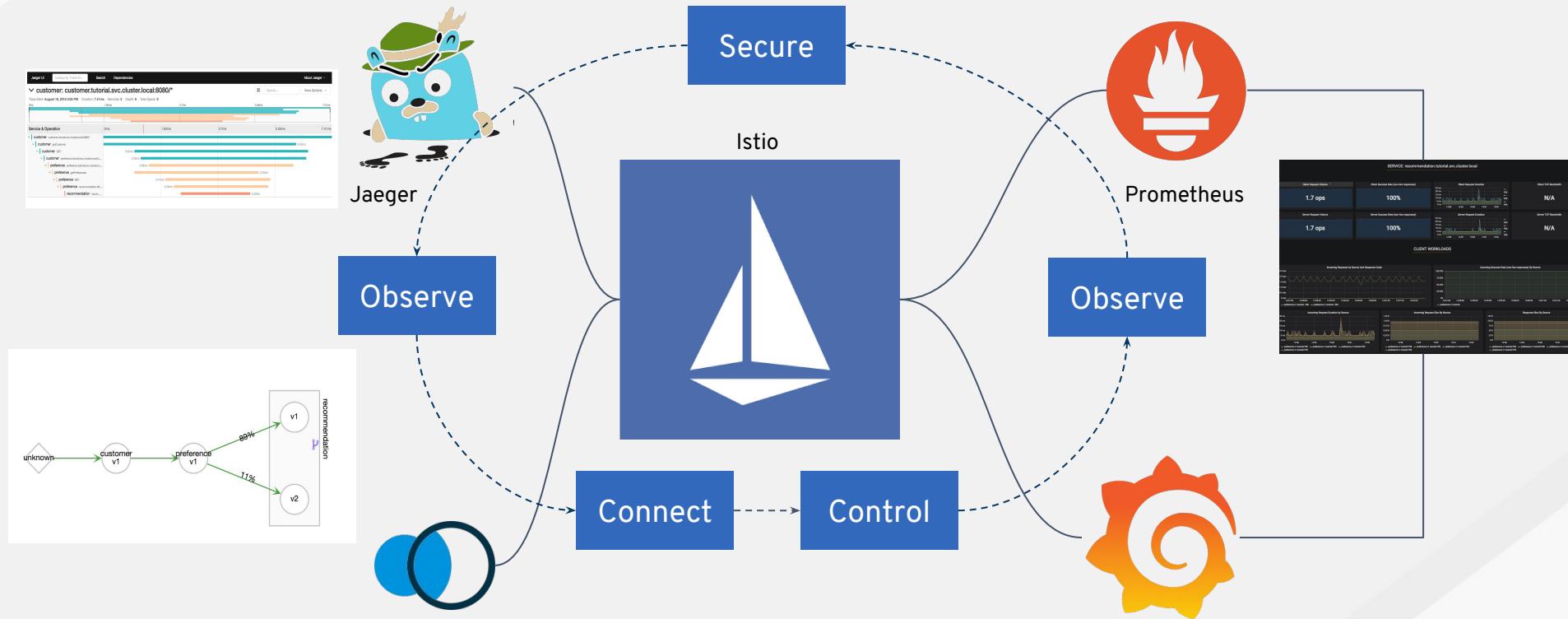
Red Hat Service Mesh

Key Features

- A dedicated network for service to service communications
- Observability and distributed tracing
- Policy-driven security
- Routing rules & chaos engineering
- Powerful visualization & monitoring
- Will be available via OperatorHub



OPENSOURCE SERVICE MESH (OSM)



accenture[>]

High performance. Delivered.

Container Security Reference Architecture

>
accenture

High performance. Delivered.

Security in OpenShift

AUTOMATED & INTEGRATED 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

CONTENT: CONTAINER HEALTH INDEX

The following grades and icons are used with a brief explanation of how they are calculated.



Grade A: This image does not contain known unapplied errata that fix Critical or Important flaws.



Grade B: This image may be missing Critical or Important security errata, but no missing Critical flaw is older than 7 days and no missing Important flaw is older than 30 days.



Grade C: This image may be missing Critical or Important security errata, but no missing Critical flaw is older than 30 days and no missing Important flaw is older than 90 days.



Grade D: This image may be missing Critical or Important security errata, but no missing Critical flaw is older than 90 days and no missing Important flaw is older than 365 days.



Grade E: This image may be missing Critical or Important security errata, but no missing Critical or Important flaw is older than 365 days.



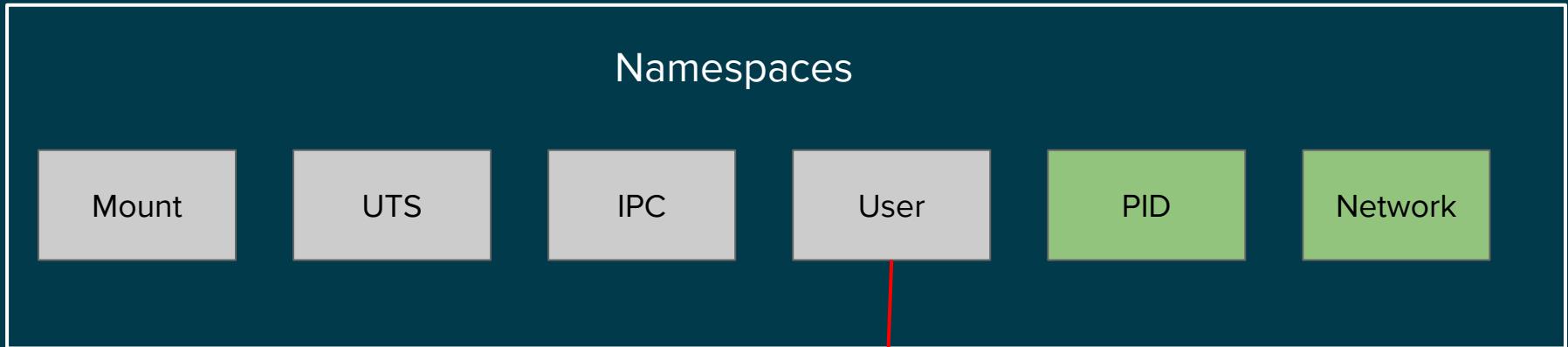
Grade F: This image may be missing Critical or Important security errata, and they are older than 365 days. Or the container is out of its lifecycle.



Grade Unknown: This image cannot be scanned as it is missing metadata required to perform the Container Health Index calculation.

NAMESPACES

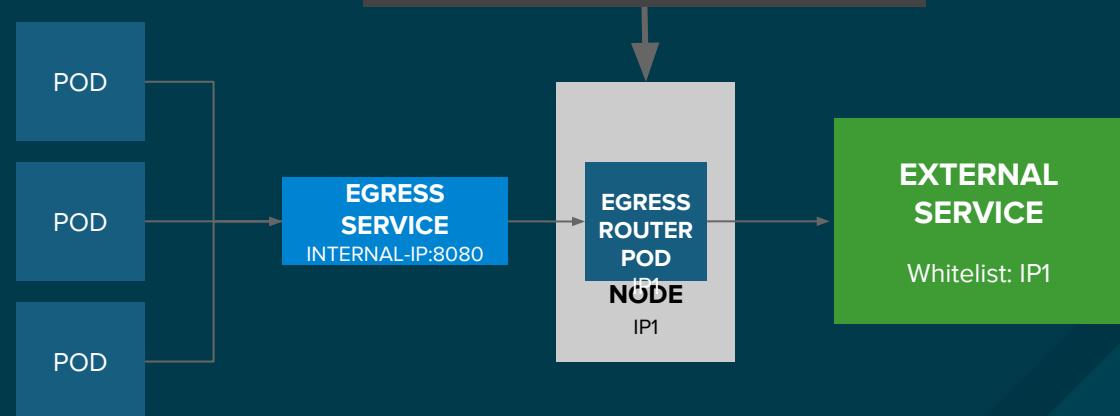
Process Isolation



New in RHEL 7.4

NETWORK DEFENSE: EGRESS ROUTER

The OpenShift egress router runs a service that redirects egress pod traffic to one or more specified remote servers, using a pre-defined source IP address that can be whitelisted on the remote server. The egress router can also be run as a proxy.



NETWORK POLICIES

Use of a NetworkPolicy allows for pod isolation.

The policy only has effect when the network plugin, like Project Calico, are capable of honoring them. If used with a plugin like flannel they will have no effect.

The use of matchLabels allows for more granular selection within the namespace which can be selected using a namespaceSelector. Using multiple labels can allow for complex application of rules.

<https://kubernetes.io/docs/concepts/services-networking/network-policies/>

```
1 apiVersion: networking.k8s.io/v1
2 kind: NetworkPolicy
3 metadata:
4   name: test-network-policy
5   namespace: default
6 spec:
7   podSelector:
8     matchLabels:
9       role: db
10    policyTypes:
11      - Ingress
12      - Egress
13    ingress:
14      - from:
15        - ipBlock:
16          cidr: 172.17.0.0/16
17          except:
18            - 172.17.1.0/24
19        - namespaceSelector:
20          matchLabels:
21            project: myproject
22        - podSelector:
23          matchLabels:
24            role: frontend
25        ports:
26          - protocol: TCP
27            port: 6379
28    egress:
29      - to:
30        - ipBlock:
31          cidr: 10.0.0.0/24
32        ports:
33          - protocol: TCP
34            port: 5978
```



[Aporeto](#)



[AquaSecurity](#)



[Avi Networks](#)



[big switch](#)



[Black Duck](#)



[Cisco Contiv](#)



[Contrail](#)



[dynatrace](#)



[f5](#)



[JFrog, Inc.](#)



[HashiCorp](#)



[NeuVector](#)



[NGINX](#)



[nuagenetworks](#)



[Portworx](#)



[Signal Sciences](#)

[Signal Sciences](#)



[Sonatype](#)



[Sysdig](#)



[Thales e-Security](#)



[Tigera](#)

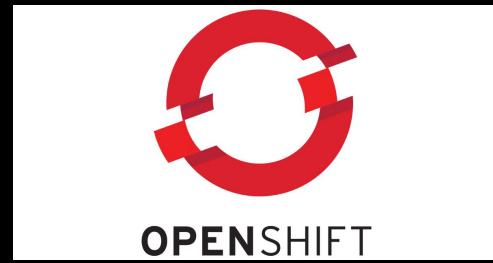


[Treasure Data](#)



[Tremolo](#)

OpenShift 4 - The Automated Platform



Moving into the 3rd Era of Kubernetes

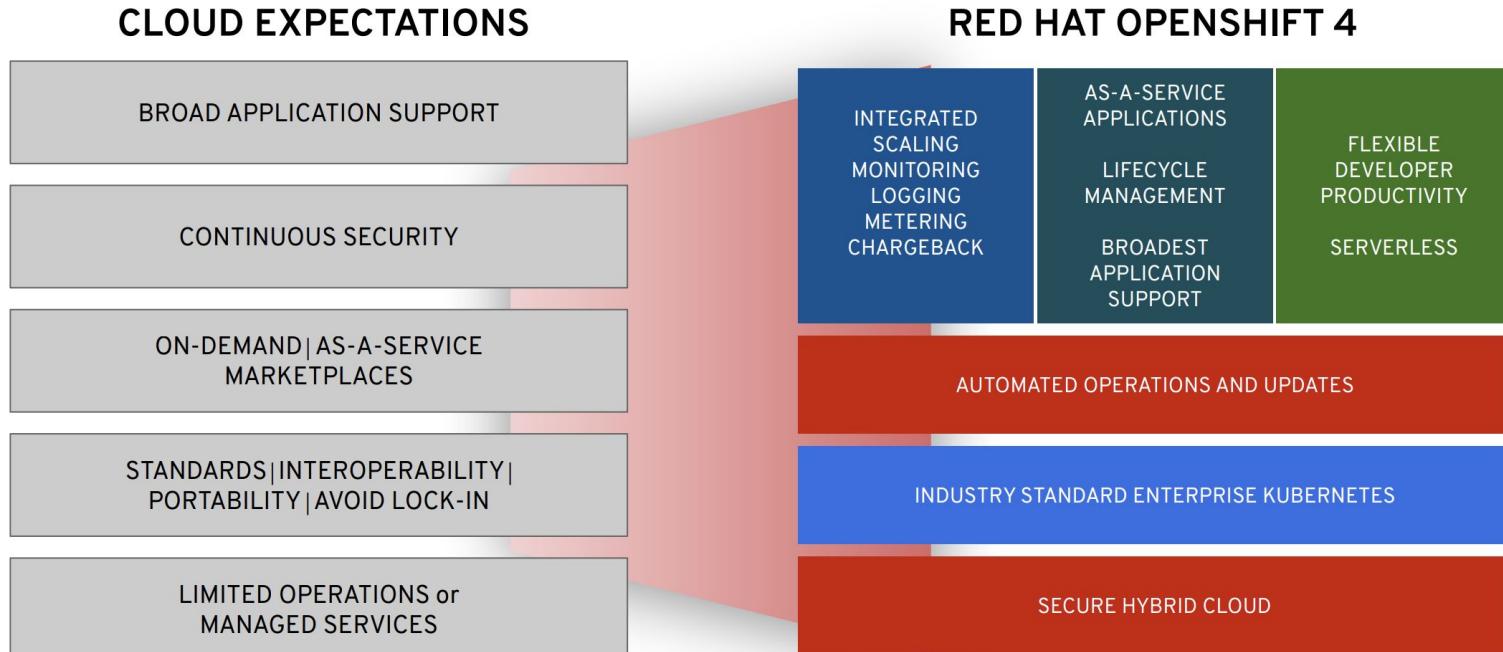


1st Generation
2015-2016

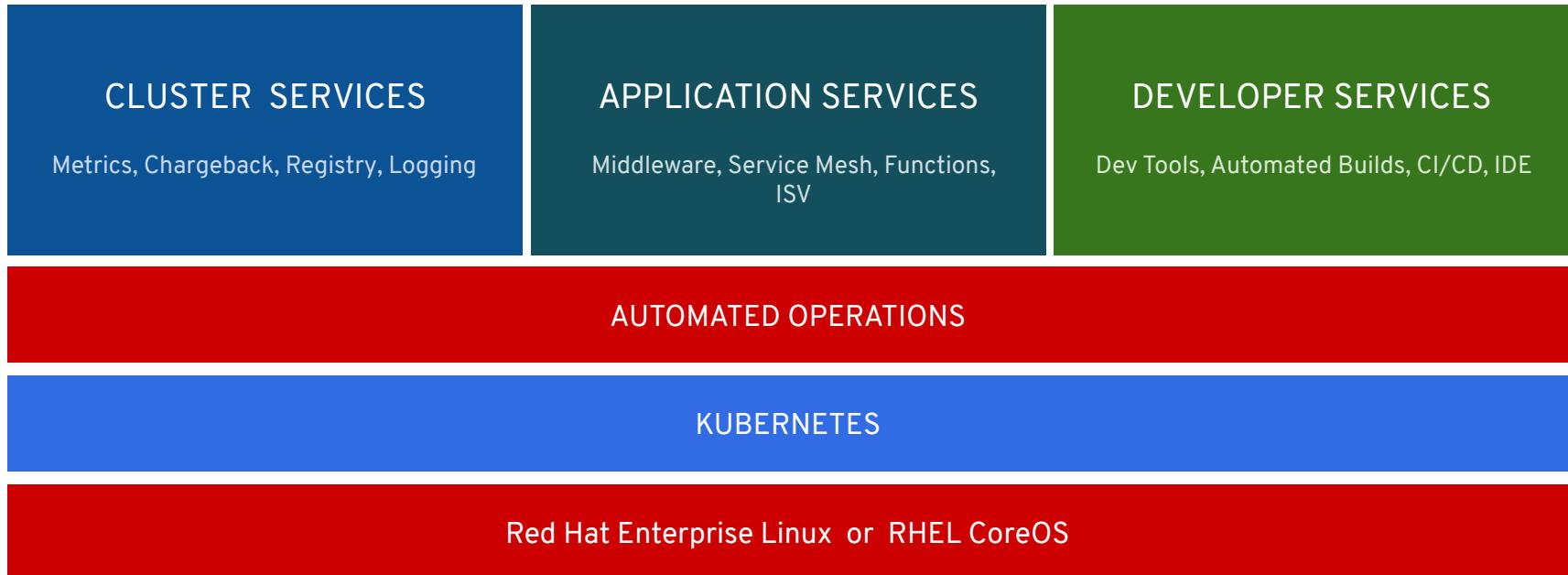
2nd Generation
2016-2017

3rd Generation
2018-2020

Bringing Learnings from the Public Cloud to the Hybrid Cloud



OpenShift 4 Platform



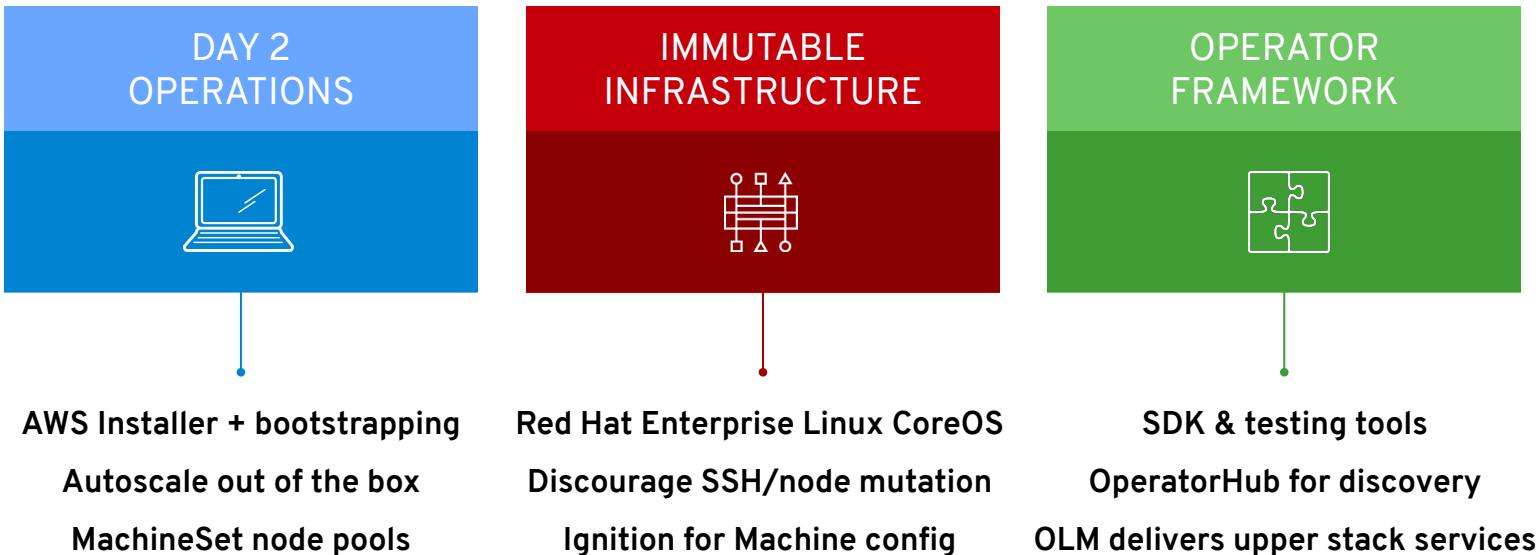
Best IT Ops Experience

CaaS \longleftrightarrow PaaS \longleftrightarrow FaaS

Best Developer Experience



OpenShift 4.1 Workstreams Lifecycle



Installation Experiences

OPENSHIFT CONTAINER PLATFORM

Full Stack Automated

Simplified opinionated “Best Practices” for cluster provisioning

Fully automated installation and updates including host container OS.

Pre-existing Infrastructure

Customer managed resources & infrastructure provisioning

Plug into existing DNS and security boundaries

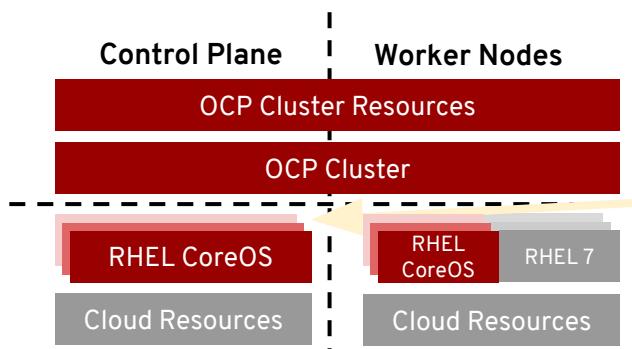
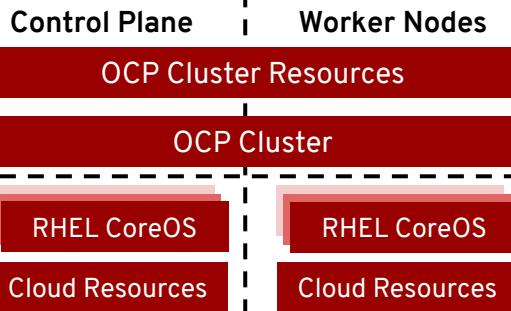
HOSTED OPENSHIFT

Azure Red Hat OpenShift

Deploy directly from the Azure console.

OpenShift Dedicated

Get a powerful cluster, fully Managed by Red Hat engineers and support.

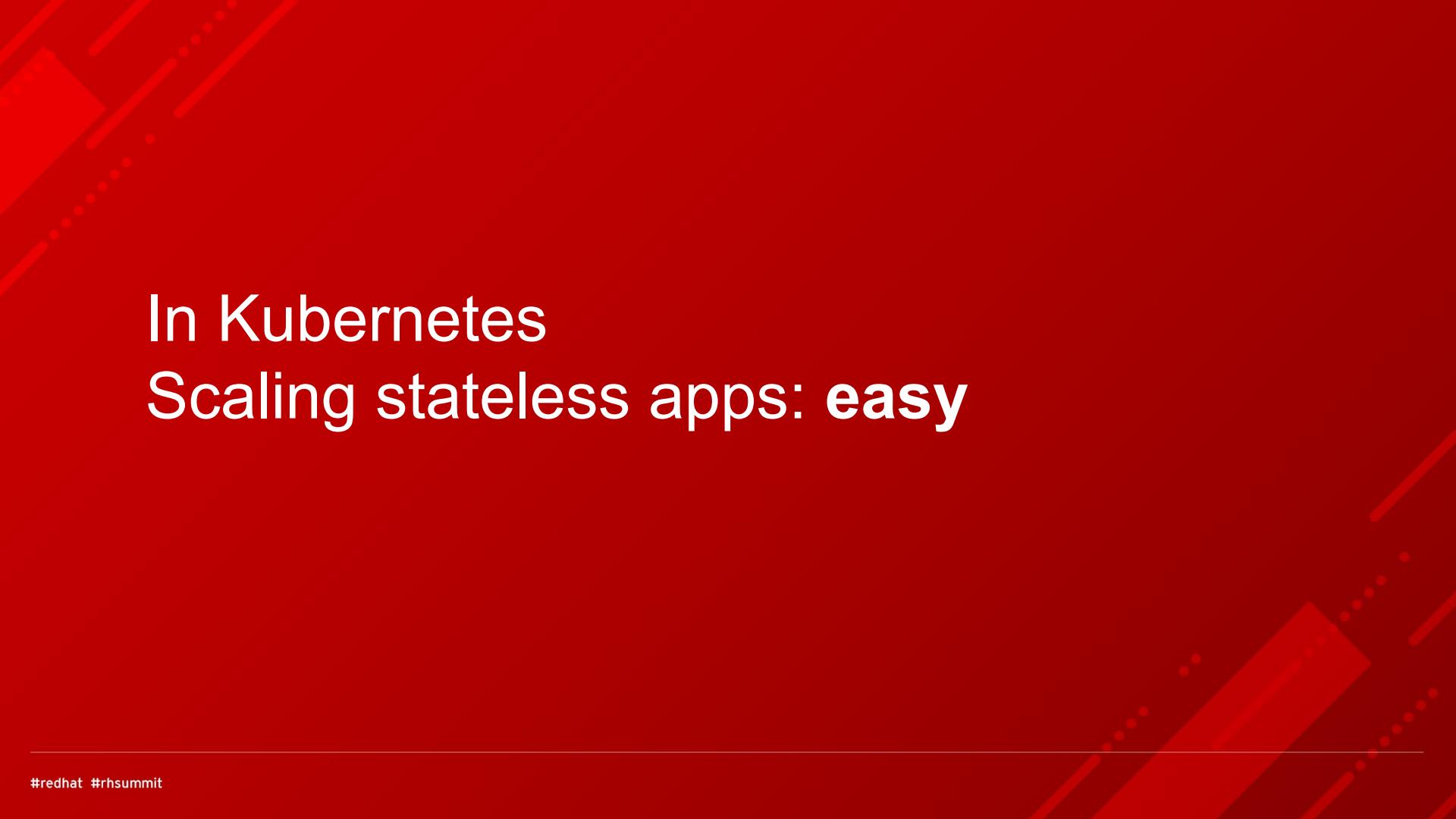


- Customer Deployed / User managed
- OpenShift install deployed and Operator managed



DEMO

Operators

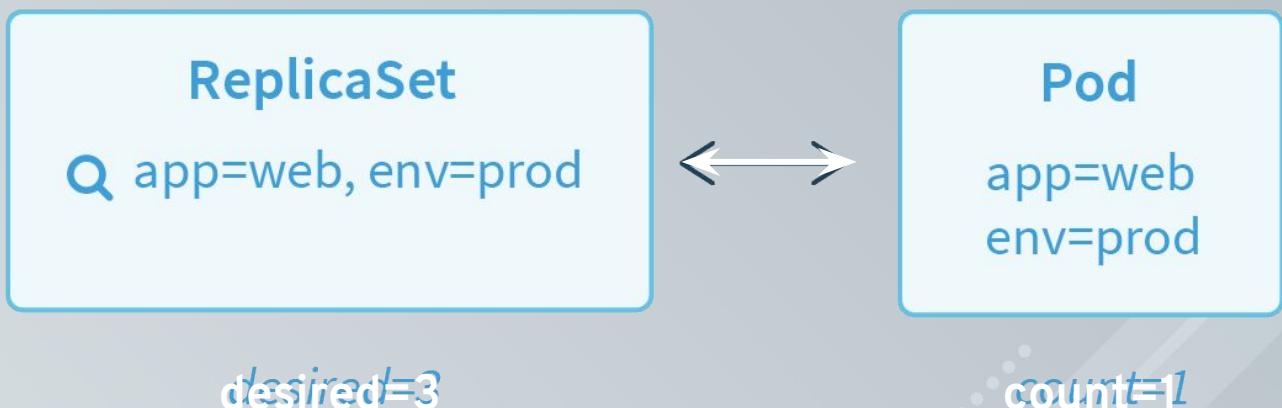


In Kubernetes Scaling stateless apps: **easy**

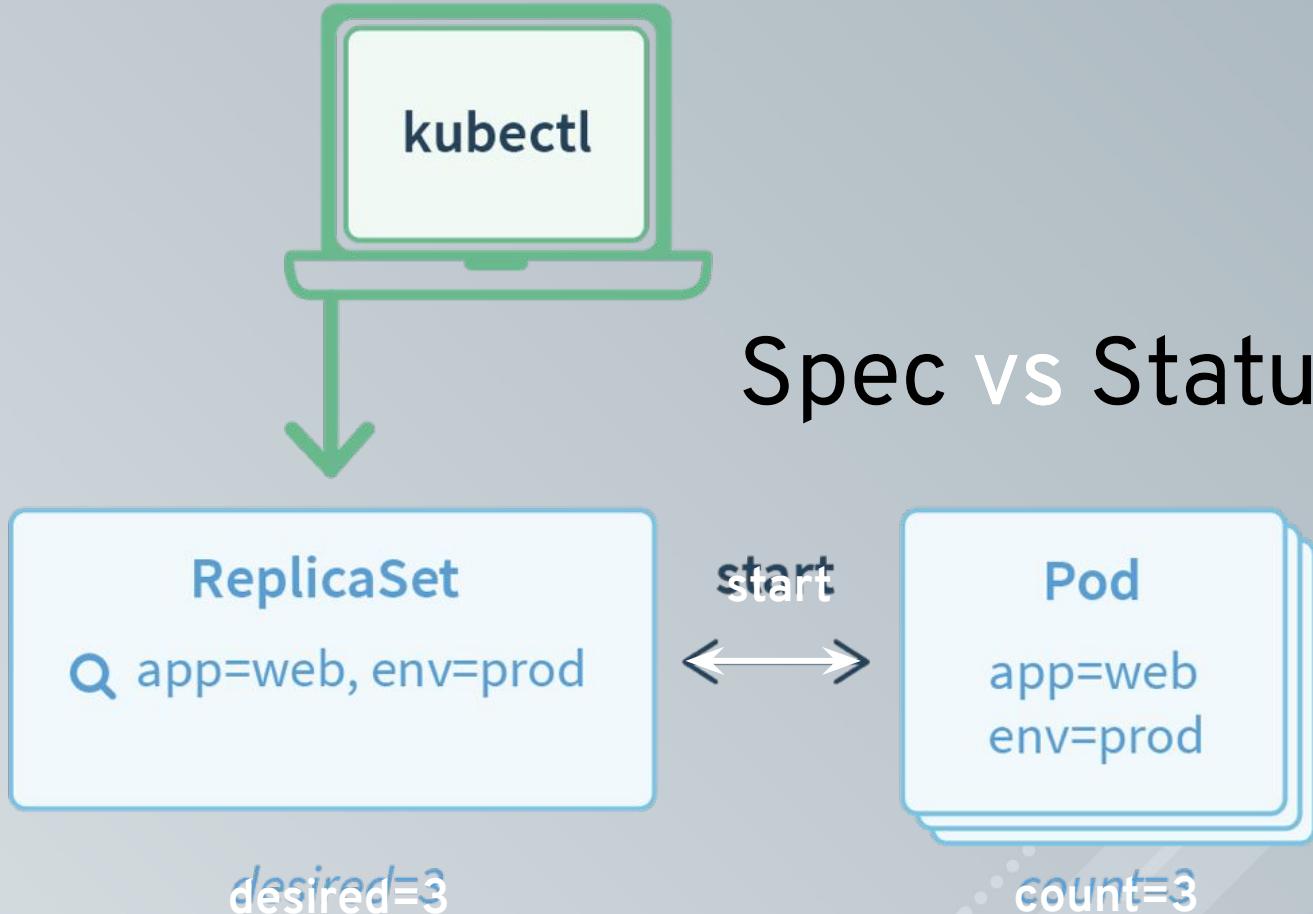
```
$ kubectl scale deploy/staticweb --replicas=3
```



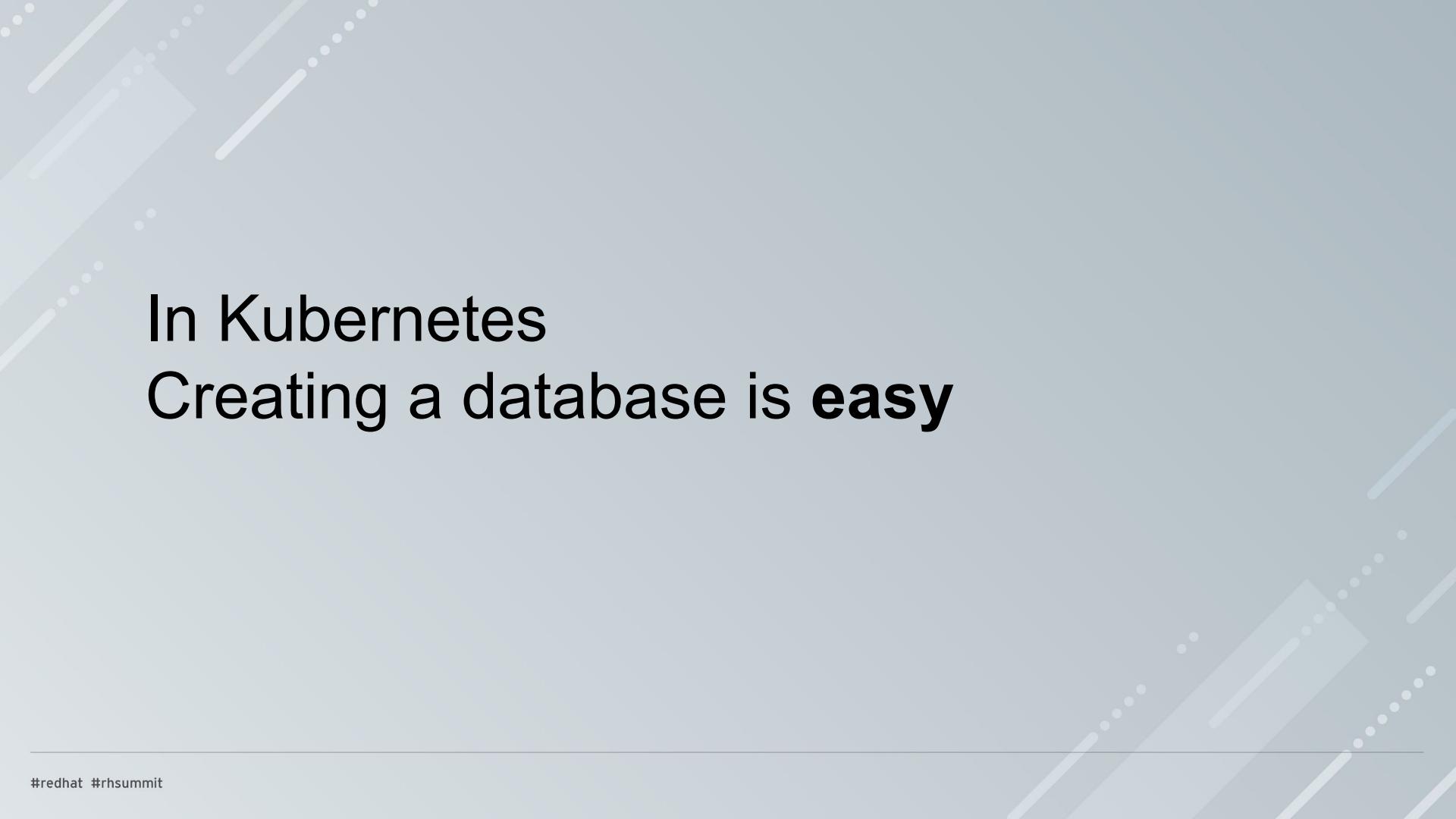
Spec vs Status



Spec vs Status



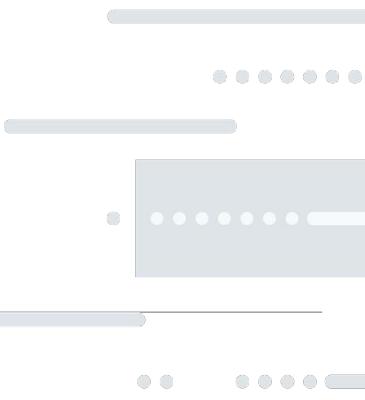
What about apps that **store data**?



In Kubernetes Creating a database is **easy**

```
$ kubectl run db --image=quay.io/my/db
```

Running a database **over time** is harder

A decorative graphic consisting of three horizontal grey bars of varying lengths. The first bar is the longest, the second is shorter, and the third is the shortest. Each bar has a series of small white dots at its right end, suggesting a continuation or a timeline.

- Resize
- Reconfigure
- Backups
- Healing
- Patching
- Upgrades

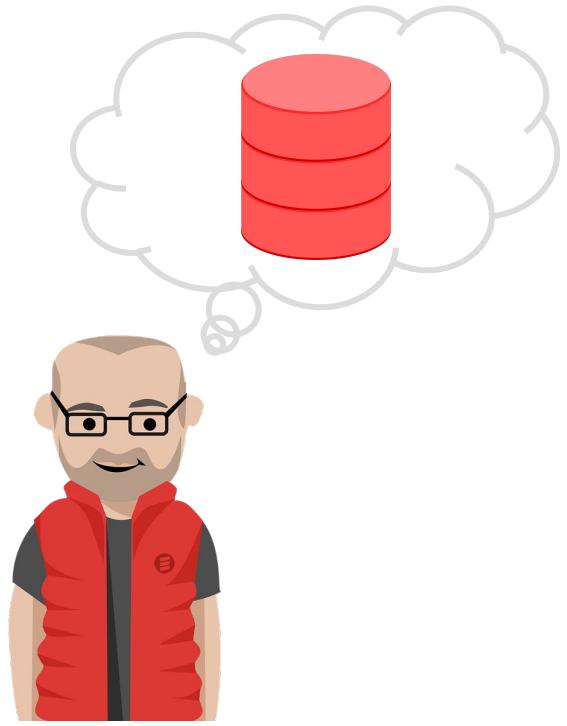


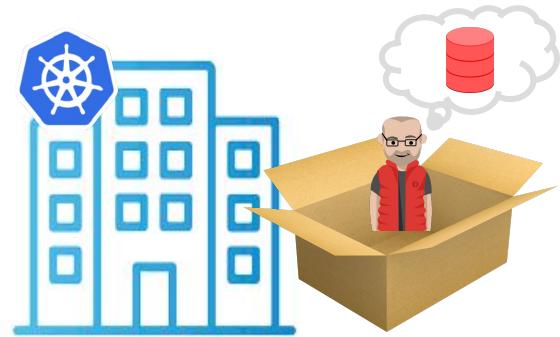
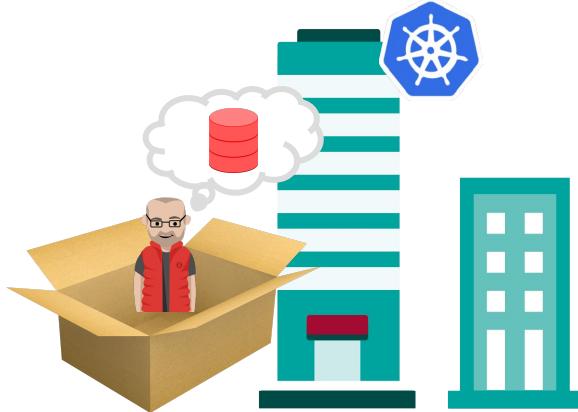
1. Every application on any platform must be **installed, configured, managed**, and **upgraded** over time
2. Patching is critical to Security



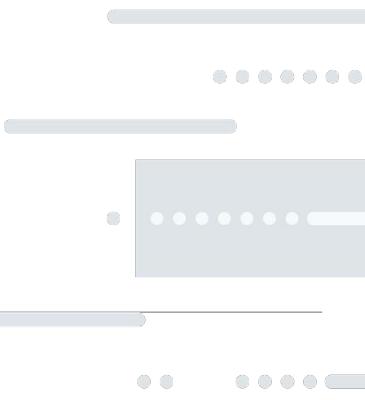
Anything not automated is slowing you down

If only Kubernetes knew...



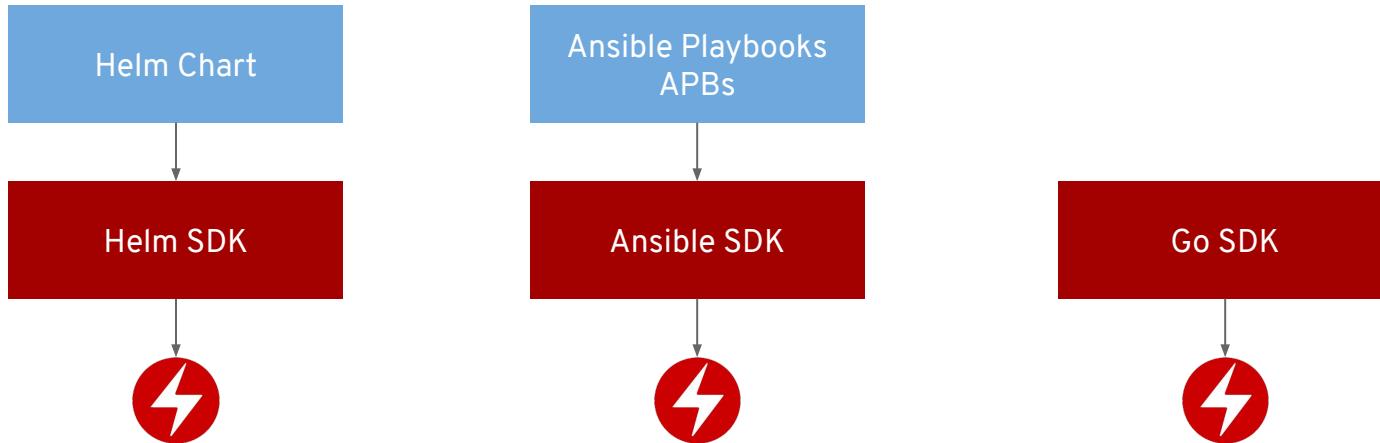


Operators are **automated software managers** that deal with installation and lifecycle of Kubernetes applications

A decorative graphic in the bottom right corner consisting of several horizontal grey bars of varying lengths. Between these bars are small white circles, some of which have short vertical lines extending upwards from them, creating a pattern reminiscent of a digital interface or a progress bar.

DEMO

Build Operators for your apps





Basic Install

Automated application provisioning and configuration management

Seamless Upgrades

Patch and minor version upgrades supported

Full Lifecycle

App lifecycle, storage lifecycle (backup, failure recovery)

Deep Insights

Metrics, alerts, log processing and workload analysis

Auto Pilot

Horizontal/vertical scaling, auto config tuning, abnormal detection, scheduling tuning



Operators for Developers

Ready-to-use Dev Tooling and Backend Operator from OperatorHub

The screenshot shows the Red Hat OpenShift Container Platform interface, specifically the OperatorHub section. The left sidebar includes navigation links for Home, Projects, Status, Search, Events, Catalog (Developer Catalog, Installed Operators, OperatorHub selected), Workloads, Networking, Storage, Builds, Monitoring, Compute, and Administration. A search bar at the top right is set to 'kube:admin'. The main content area displays a grid of operators categorized by type (All Items, AI/Machine Learning, Application Monitoring, Big Data, Database, Developer Tools, Integration & Delivery, Logging & Tracing, Monitoring, Networking, OpenShift Optional, Security, Storage, Builds, Monitoring, Compute, Administration) and provider (Red Hat, AppDynamics, Aqua Security, Automation Broker, Camel-K, Cluster Logging, CockroachDB, Community Jaeger, Couchbase Operator, Crunchy PostgreSQL, Descheduler, Dynatrace OneAgent, Elasticsearch Operator, Federation, FederatorAI, Hazelcast Operator). Each operator card includes a thumbnail, name, provider, and a brief description.

Category	Provider	Operator Name	Description
All Items	Red Hat	AMQ Streams	provided by Red Hat, Inc. Red Hat AMQ Streams is a massively scalable, distributed, and high performance data stream.
All Items	AppDynamics	AppDynamics ClusterAgent	provided by AppDynamics LLC End to end monitoring of applications on Kubernetes and OpenShift clusters with AppDynamics.
All Items	Aqua Security	Aqua Security Operator	provided by Aqua Security, Inc. The Aqua Security Operator runs within a OpenShift cluster and provides a means to deploy and manage Apps.
All Items	Community	Automation Broker Operator	provided by Red Hat, Inc. Automation Broker is an implementation of the Open Service Broker API managed by Red Hat.
All Items	Community	Camel-K Operator	provided by The Apache Software Foundation. Apache Camel K (a.k.a. Camel) is a lightweight integration framework built from Apache Camel.
All Items	Community	Cluster Logging	provided by Red Hat, Inc. The Cluster Logging Operator for OKD provides a means for configuring and managing your aggregated logging.
Database	CockroachDB	CockroachDB	provided by Helm Community CockroachDB Operator based on the CockroachDB helm chart
Database	Community	Community Jaeger Operator	provided by CNCF Provides tracing, monitoring and troubleshooting microservices-based
Database	Couchbase	Couchbase Operator	provided by Couchbase An operator to create and manage a Couchbase Cluster
Database	Community	Crunchy PostgreSQL Enterprise	provided by Crunchy Data PostgreSQL is a powerful, open source object-relational database system with enterprise features.
Database	Community	Descheduler	provided by Red Hat An operator to run the OpenShift descheduler, a scheduler to move running Pods according to policies.
Database	Dynatrace	Dynatrace OneAgent	provided by Dynatrace LLC Install full-stack monitoring of OpenShift clusters with the Dynatrace OneAgent.
Storage	Elasticsearch	Elasticsearch Operator	provided by Red Hat, Inc. The Elasticsearch Operator for OKD provides a means for configuring and managing an
Storage	Community	Federation	provided by Red Hat Gain Hybrid Cloud capabilities between your clusters with Kubernetes Federation.
Storage	Community	FederatorAI	provided by ProphetStor Data Services, Inc. FederatorAI Operator provides easy configuration and
Storage	Community	Hazelcast Operator	provided by Hazelcast, Inc. Install Hazelcast Enterprise cluster.



PIPELINES IN OPENSHIFT 4

Cloud-native CI/CD for OpenShift

Support for existing investments in Jenkins



WHAT IS CLOUD-NATIVE CI/CD?



CONTAINERS

Built for containers and runs on Kubernetes



SERVERLESS

No CI/CD server to manage and maintain



DEVOPS

Microservices and distributed teams



TEKTON

Based on Tekton pipelines - set of shared, open source components for building Kubernetes-style CI/CD systems

Governed by the Continuous Delivery Foundation

Contributions from Google, Red Hat, Cloudbees, Pivotal, IBM and more





OpenShift Serverless + Azure Functions

KEDA allows for fine grained autoscaling (including to/from zero) for event driven Kubernetes workloads.

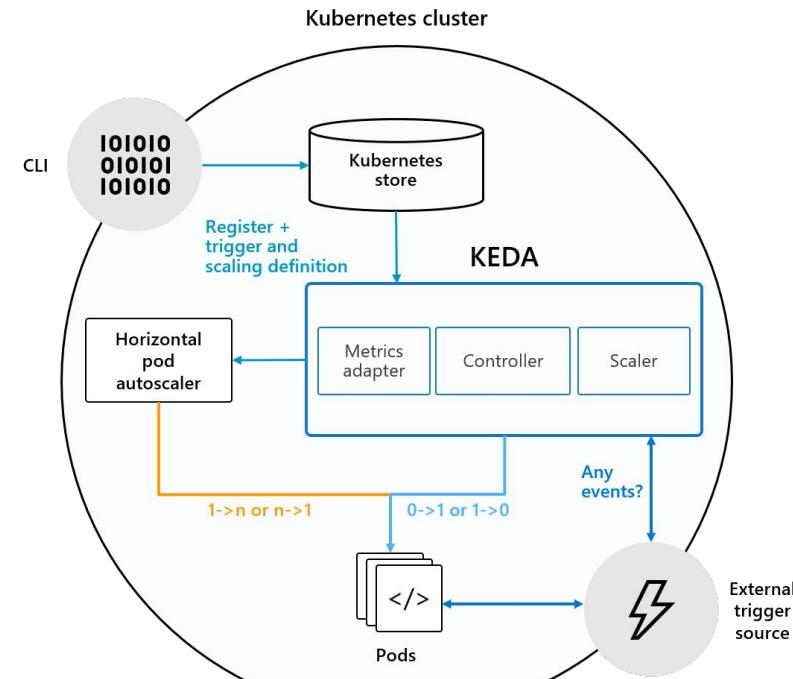
KEDA serves as a Kubernetes Metrics Server and allows users to define autoscaling rules using a dedicated Kubernetes custom resource definition.

Key Features

- Enable FaaS in OpenShift
- Polling based auto-scaling for Azure Queues, Kafka...
- Reuse Knative event sources, HTTP auto-scaling
- On premise or Any cloud.

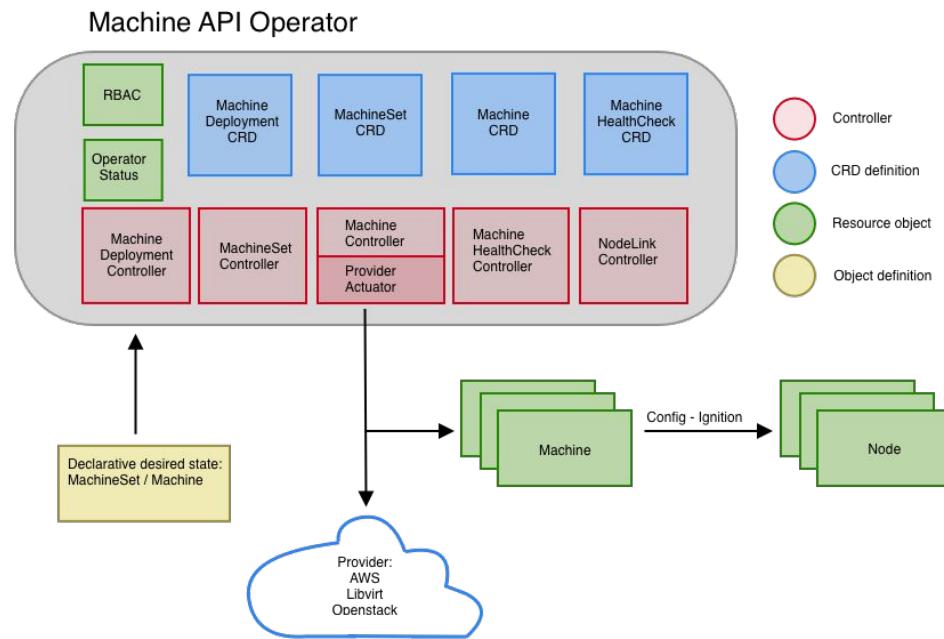
Learn more

<https://github.com/kedacore/keda>



Cloud API

- Provide a single view and control across multiple cluster types
- *Machine API*:
 - Set up definitions via CRDs
 - Machine: a node
 - MachineSet: think ReplicaSet
 - Actuators roll definitions across clusters
 - Nodes are drained before deletion
- *Cluster Autoscaler*: provide/remove additional nodes on demand
- AWS (4.1), Azure/GCP (target 4.2), VMWare (Future)



DEMO

2019 Roadmap

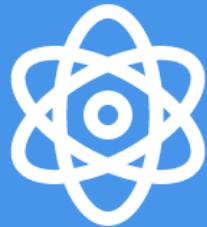
Q2 CY2019 OpenShift 4.1		Q3 CY2019 OpenShift 4.2		Q4 CY19/Q1 CY20 OpenShift 4.3	
HOSTED	HOSTED	PLATFORM	APP	DEV	HOSTED
<ul style="list-style-type: none">• OpenShift Serverless (Knative) - DP• OpenShift Pipelines (Tekton) Dev Preview• CodeReady Workspaces• CodeReady Containers Alpha• Developer CLI (odo) Beta <ul style="list-style-type: none">• OperatorHub• Operator Lifecycle Manager• Service Mesh (~2 month after) <ul style="list-style-type: none">• Kubernetes 1.13 with CRI-O runtime• RHEL CoreOS, RHEL7• Automated Installer for AWS• Pre-existing Infra Installer for Bare Metal, VMware, AWS• Automated, one-click updates• Multus (Kubernetes multi-network)• Quay v3 <ul style="list-style-type: none">• cloud.redhat.com - Multi-Cluster Mgmt• OCP Cluster Subscription Management• Azure Red Hat OpenShift• OpenShift Dedicated consumption pricing	<ul style="list-style-type: none">• OpenShift Serverless (Knative) - GA• OpenShift Pipelines (Tekton) Tech Preview• CodeReady Containers GA• Developer CLI (odo) GA <ul style="list-style-type: none">• GPU metering• OperatorHub Enhancements• Operator Deployment Field Forms• Application Binding with Operators• Application Migration Console <ul style="list-style-type: none">• Kubernetes 1.14 w/ CRI-O runtime• Disconnected Install and Update• Automated Installer for Azure, OSP, GCP• OVN Tech Preview• FIPS• Federation Workload API• Automated App cert rotation• OpenShift Container Storage 4.2 <ul style="list-style-type: none">• cloud.redhat.com - Multi-Cluster Deployment• Proactive Support Operator	<ul style="list-style-type: none">• OpenShift Serverless (Knative) - GA• OpenShift Pipelines (Tekton) GA <ul style="list-style-type: none">• Metering for Services• Windows Containers <ul style="list-style-type: none">• Kubernetes 1.15 w/ CRI-O runtime• Automated Installer for IBM Cloud, Alibaba, RHV, Bare Metal Hardware Appliance• Pre-existing Infra Installer for Azure, OSP, GCP• OVN GA w/ Windows Networking Integration <ul style="list-style-type: none">• cloud.redhat.com - Subscription Mgmt Consumption Improvements			



QUARKUS

Supersonic. Subatomic. Java.

A stack to write Java apps



Cloud Native,

Microservices,

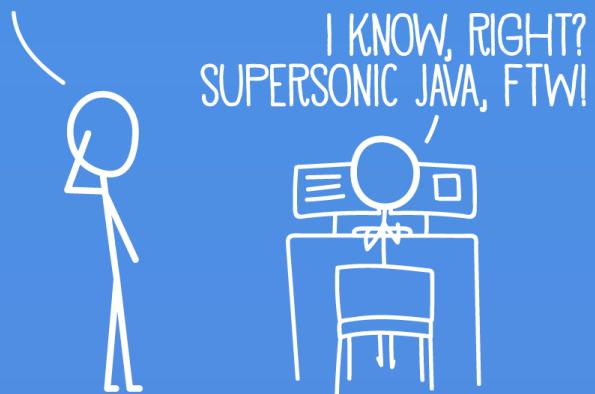
Serverless

Developer Joy

A cohesive platform for optimized developer joy:

- Based on standards, but not limited
- Unified configuration
- Zero config, live reload in the blink of an eye
- Streamlined code for the 80% common usages, flexible for the 20%
- No hassle native executable generation

WAIT.
SO YOU JUST SAVE IT,
AND YOUR CODE IS RUNNING?
AND IT'S JAVA?!

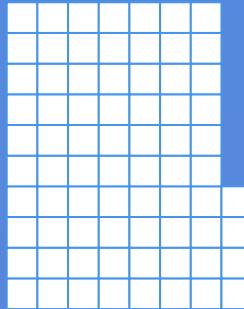


Supersonic Subatomic Java

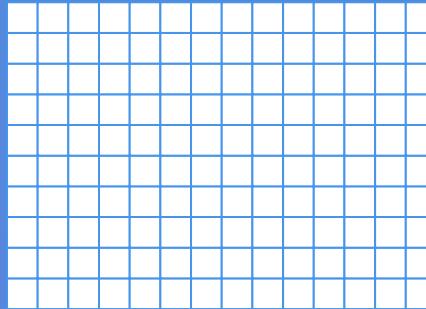
REST



Quarkus + GraalVM
13 MB



Quarkus + OpenJDK
74 MB



Traditional Cloud-Native Stack
74 MB

Memory (RSS) in Megabytes

Quarkus + GraalVM **0.014 Seconds**

Quarkus + OpenJDK **0.75 Seconds**

Traditional Cloud-Native Stack **4.3 Seconds**

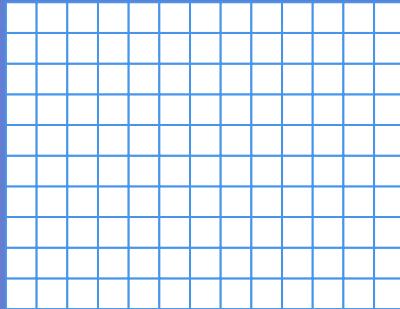
Boot + First Response Time (in seconds)

Supersonic Subatomic Java

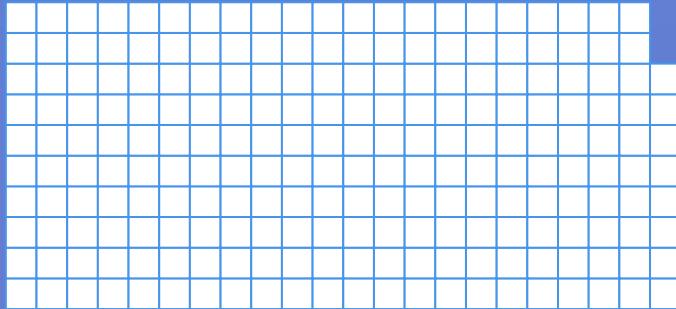
REST + CRUD



Quarkus + GraalVM
35 MB



Quarkus + OpenJDK
130 MB



Traditional Cloud-Native Stack
218 MB

Memory (RSS) in Megabytes

Quarkus + GraalVM **0.055 Seconds**

Quarkus + OpenJDK **2.5 Seconds**

Traditional Cloud-Native Stack **9.5 Seconds**

Boot + First Response Time (in seconds)

Frameworks & Standards



Eclipse Vert.x



Hibernate



RESTEasy



Apache Camel



Eclipse
MicroProfile



Netty



Kubernetes



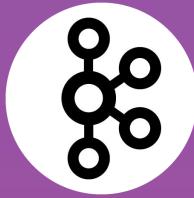
OpenShift



Jaeger



Prometheus



Apache Kafka



Infinispan