OpenShift 4

For Developers

Wanja Pernath
wpernath@redhat.com
EMEA Partner Enablement Manager, OpenShift & MW

Red Hat

Self introduction

Name: Wanja Pernath

Email: wpernath@redhat.com

Base: Germany (very close to the Alps)

Role: EMEA Technical Partner Development Manager - OpenShift and MW

Experience: Years of Consulting, Training, PreSales at Red Hat and before

Twitter: https://twitter.com/wpernath

LinkedIn:https://www.linkedin.com/in/wanjapernath/

First book just published

Getting GitOps

A technical blueprint for developing with Kubernetes and OpenShift based on a REST microservice example written with Quarkus

Technologies discussed:

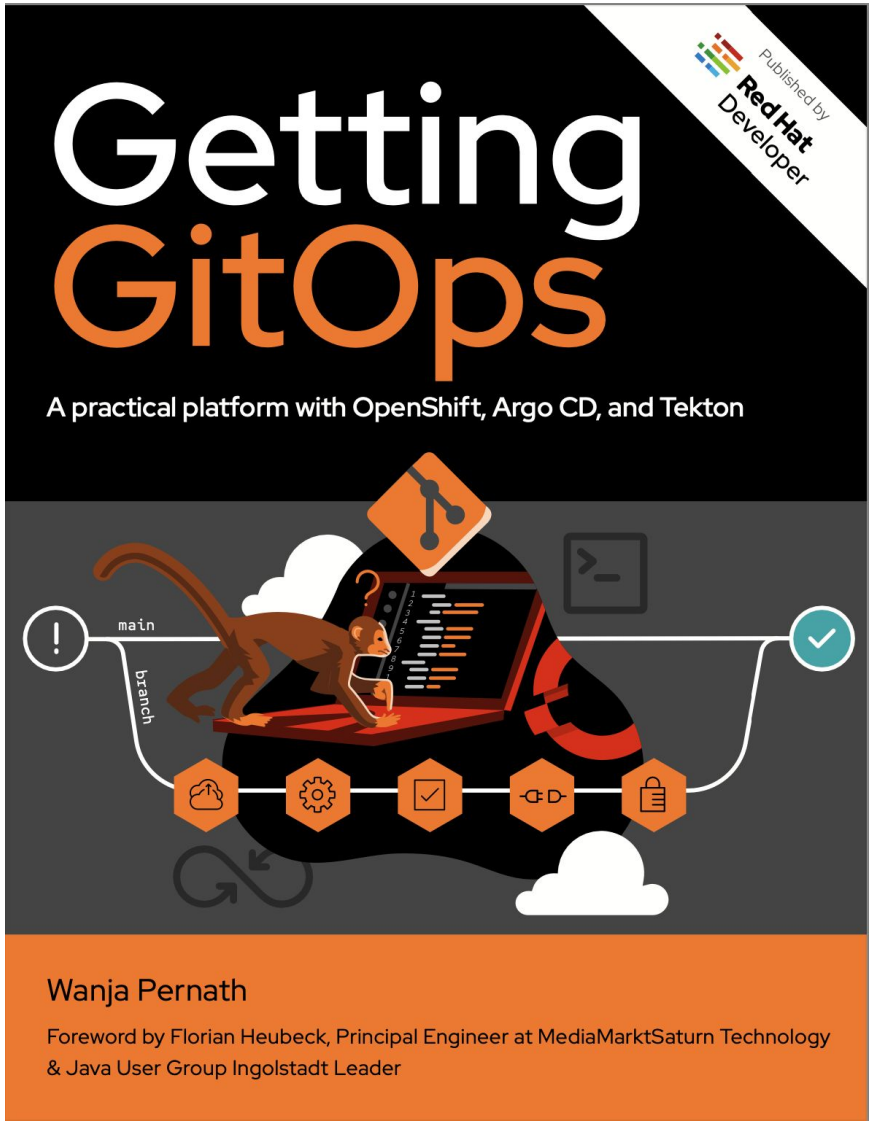
Quarkus, Helm Charts, Kustomize, Tekton Pipelines, Kubernetes Operators, OpenShift Templates, ArgoCD, CI/CD, GitOps….

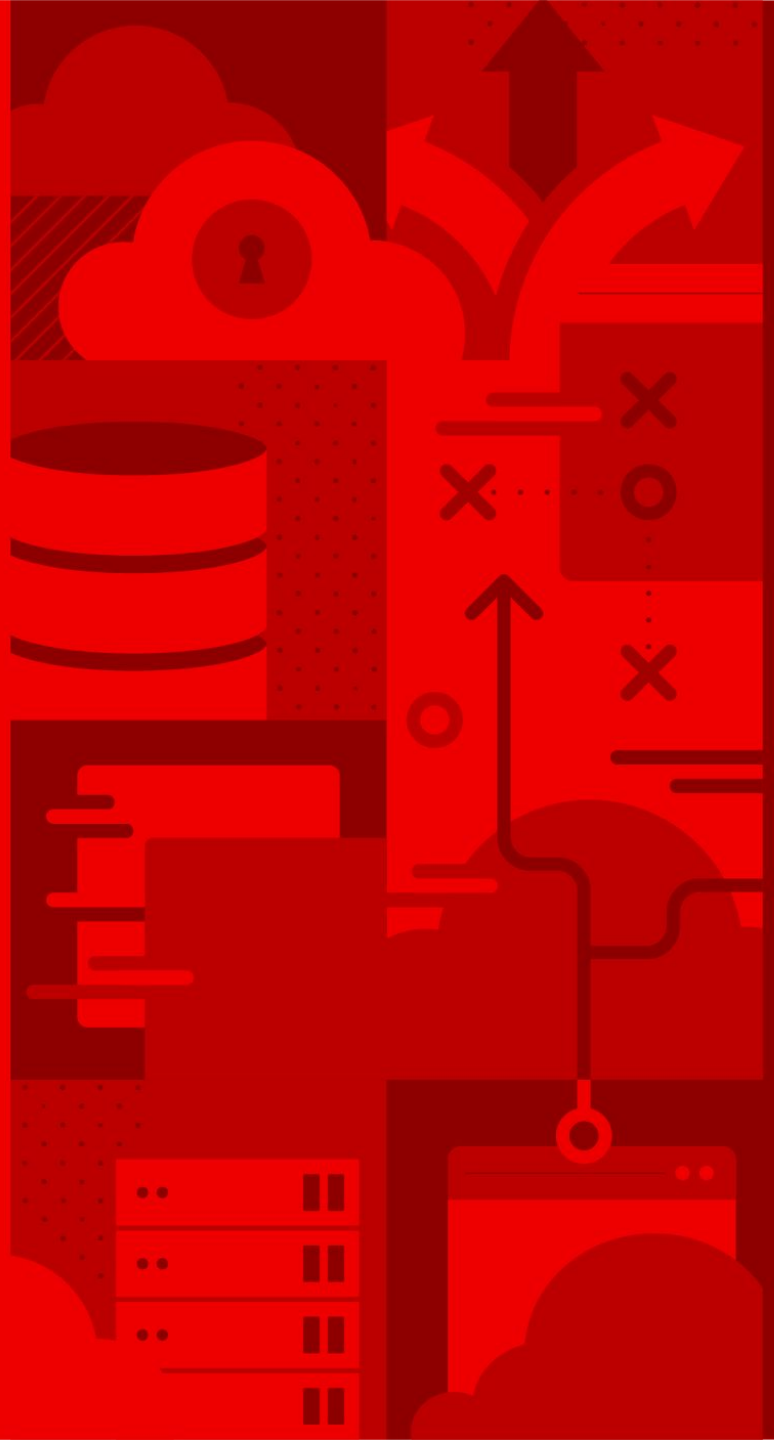
Download for free at:

https://developers.redhat.com/e-books/getting-gitops-practical-platform-openshift-argo-cd-and-tekton

Interview with full GitOps Demo:

https://www.youtube.com/watch?v=znMfVqAIRzY&ab_channel=OpenShift





A few words on Podman Desktop

Red Hat

podman desktop

Introducing Podman Desktop

Containers and Kubernetes for Application Developers

Podman and Kubernetes/OpenShift Local

- Install and run anywhere: Windows, Mac and Linux
- Keep it up-to-date

Containers and Pods

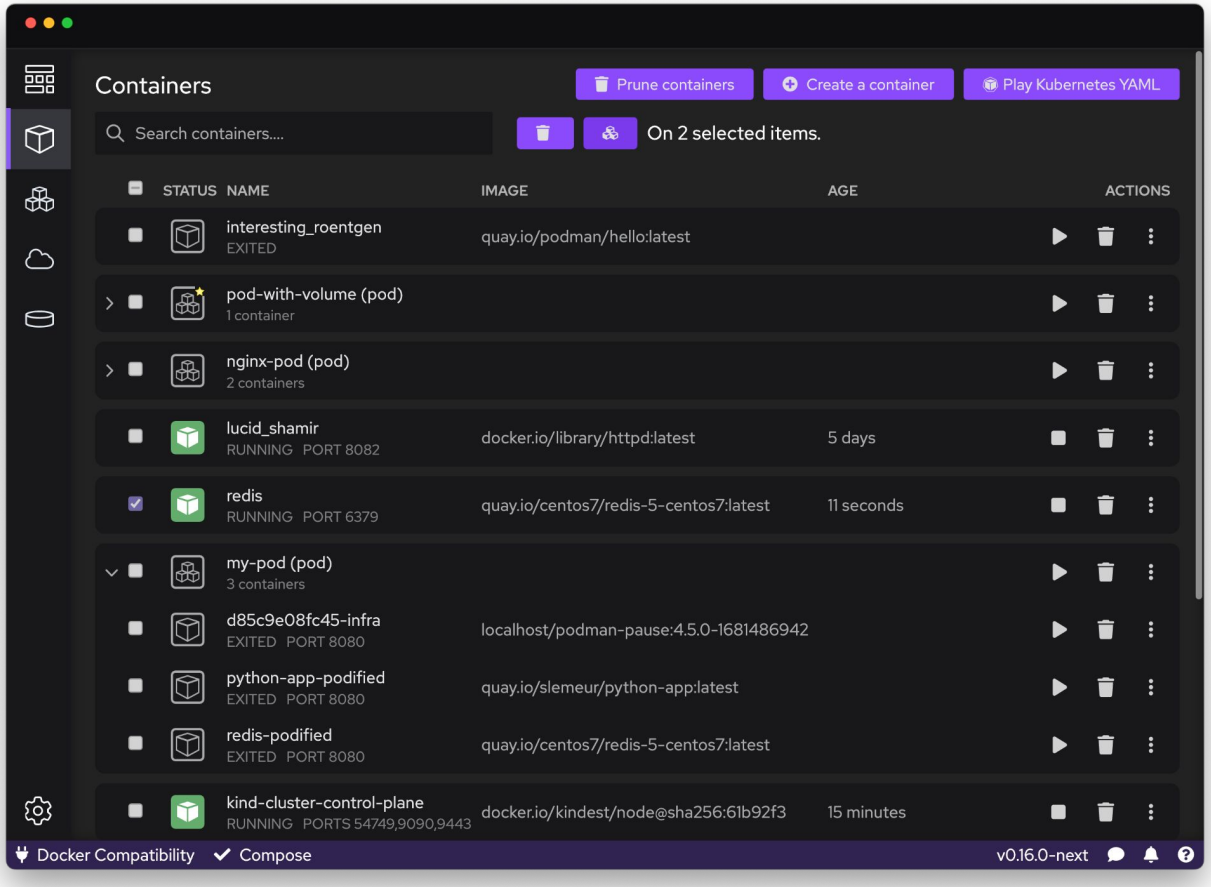
- Build, run, manage and debug Containers and Pods
- Run Pods with or without Kubernetes
- Manage multiple container Engines
- Compatibility with Docker Compose

Enterprise Readiness

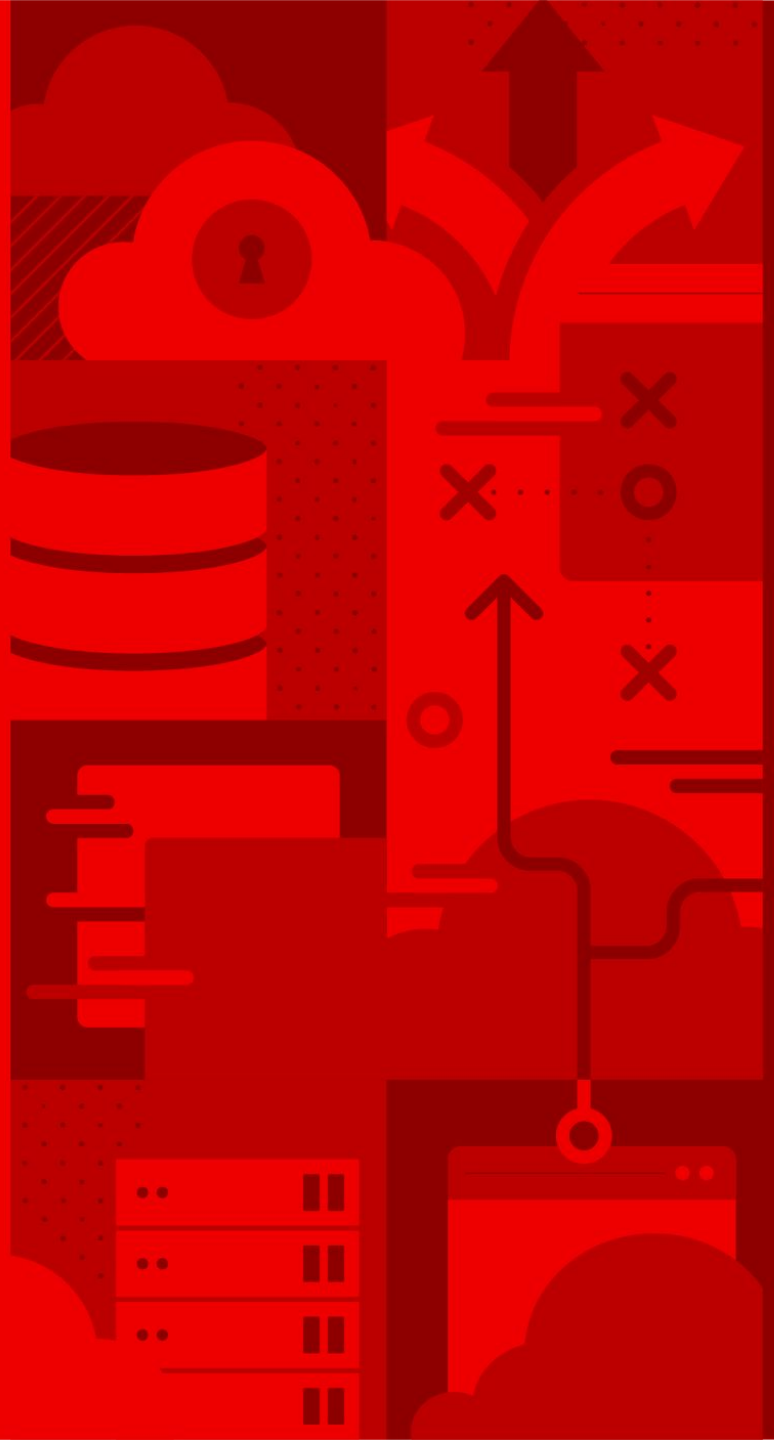
- VPN and Proxies configuration
- Image registry management
- AirGapped Installation

Bridge between local and remote

- Connect and deploy to remote OpenShift clusters
- Enable remote managed services locally



Red Hat



OpenShift

Developer Instances

Red Hat

Free Developer Sandbox

https://developers.redhat.com/developer-sandbox

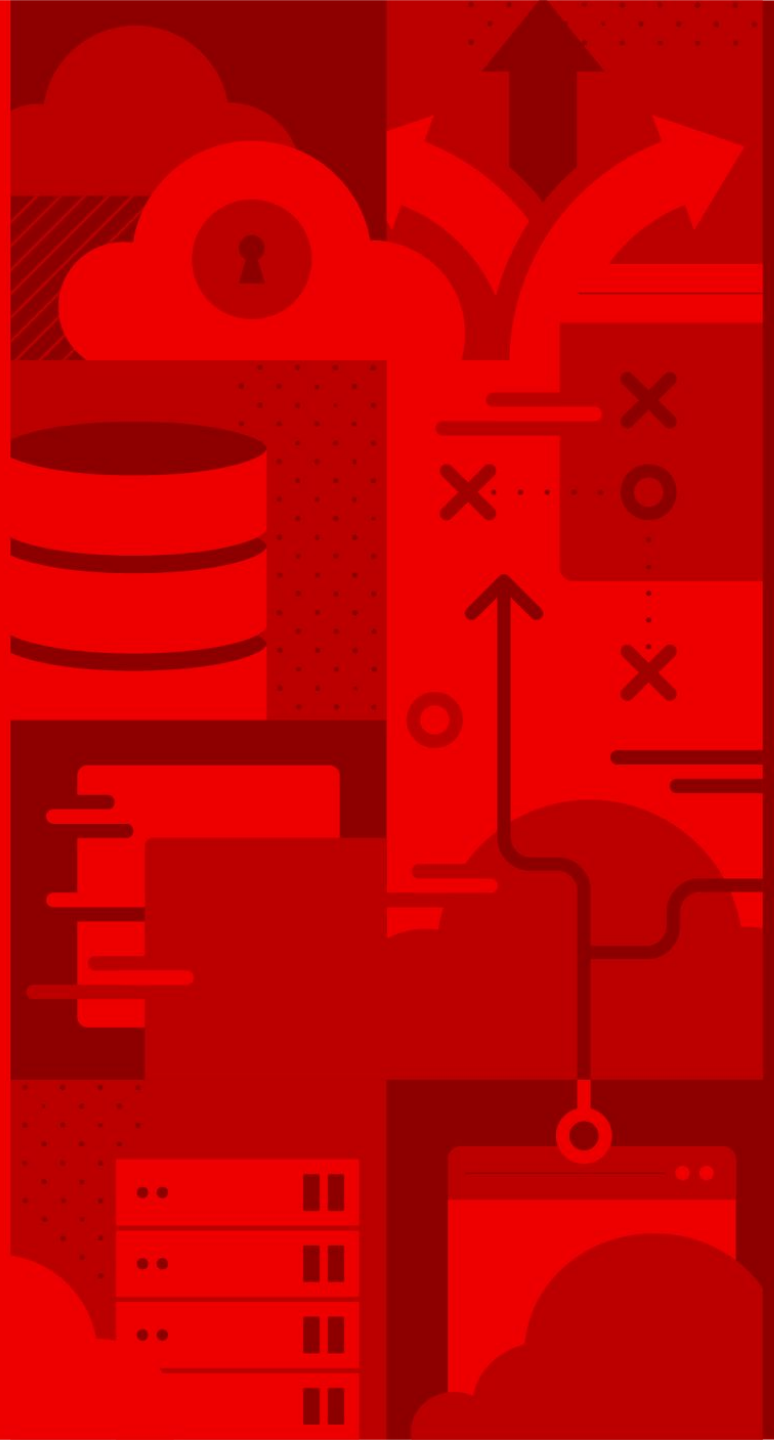
CodeReady Containers / OpenShift Local

https://github.com/code-ready/crc

Single Node OpenShift

https://console.redhat.com/openshift/assisted-installer/clusters/~new

https://www.youtube.com/watch?v=QFf0yVAHQKc



Setting up and using CodeReady Containers (crc)

Red Hat

CodeReady Containers

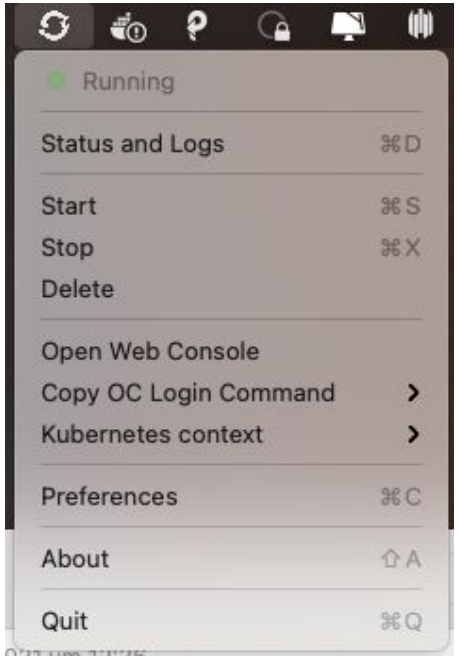
https://github.com/code-ready/crc

A single node OpenShift 4.12.x installation for local testing only

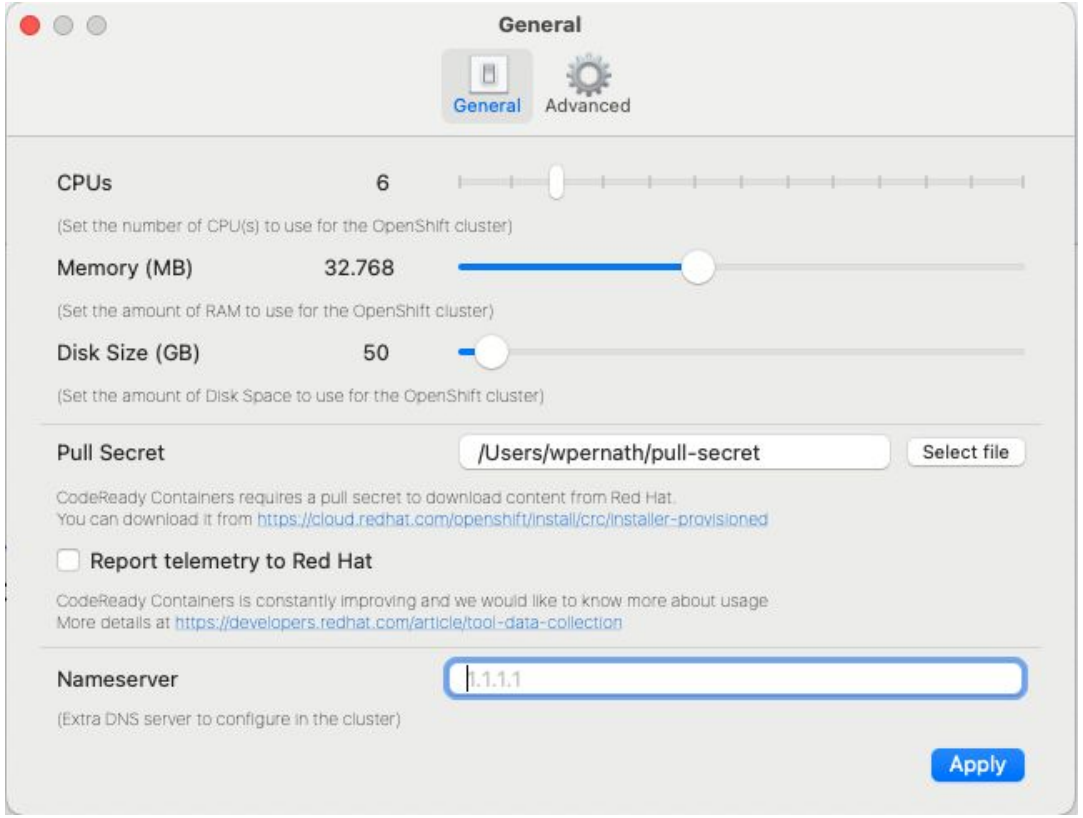
Requirements:

- 4 CPU cores
- 9GB memory
- 35GB disk space

- Download archive for your OS (mac, Linux, Windows 10)
- On mac and windows, simply install the archive
- On Linux, simply unzip the archive
- After installation, you're able to see an icon in the task or menu bar



- Set settings according to your workstation (memory, CPUs, disk size)
- Follow the instructions to download the pull-secret
- Hit Apply
- Go into a console and use “Copy OC login command” for Kubeadmin user



CRC - Advanced Settings

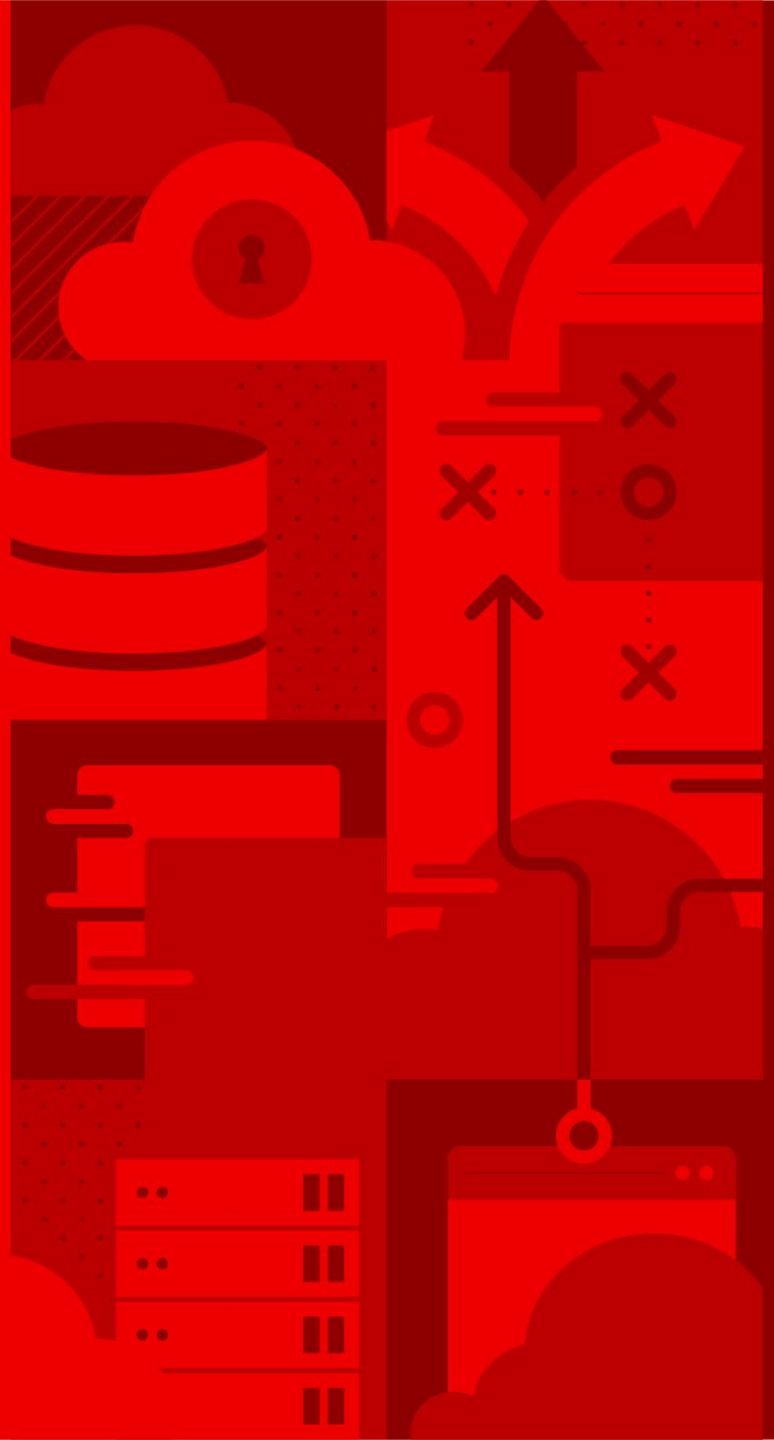
```
[wpernath@biggestmac ~/Devel/openshift-config]$ crc config list
Modifies crc configuration properties.
Properties:

* autostart-tray                      Automatically start the tray (true/false, default: true)
* bundle                              Bundle path (string, default '/Applications/CodeReady Containers.app/Contents/Resources/crc_hyperkit_4.8.4.crcbundle')
* consent-telemetry                   Consent to collection of anonymous usage data (yes/no)
* cpus                                Number of CPU cores (must be greater than or equal to '4')
* disable-update-check                Disable update check (true/false, default: false)
* disk-size                           Total size in GiB of the disk (must be greater than or equal to '31')
* enable-cluster-monitoring           Enable cluster monitoring Operator (true/false, default: false)
* enable-experimental-features        Enable experimental features (true/false, default: false)
* host-network-access                 Allow TCP/IP connections from the CodeReady Containers VM to services running on the host (true/false, default: false)
* http-proxy                          HTTP proxy URL (string, like 'http://my-proxy.com:8443')
* https-proxy                         HTTPS proxy URL (string, like 'https://my-proxy.com:8443')
* kubeadmin-password                  User defined kubeadmin password
* memory                              Memory size in MiB (must be greater than or equal to '9216')
* nameserver                          IPv4 address of nameserver (string, like '1.1.1.1 or 8.8.8.8')
* no-proxy                            Hosts, ipv4 addresses or CIDR which do not use a proxy (string, comma-separated list such as '127.0.0.1,192.168.100.1/24')
* proxy-ca-file                       Path to an HTTPS proxy certificate authority (CA)
* pull-secret-file                    Path of image pull secret (download from https://cloud.redhat.com/openshift/create/local)
* skip-check-admin-helper-cached      Skip preflight check (true/false, default: false)
* skip-check-bundle-extracted         Skip preflight check (true/false, default: false)
* skip-check-hyperkit-driver          Skip preflight check (true/false, default: false)
* skip-check-hyperkit-installed       Skip preflight check (true/false, default: false)
* skip-check-m1-cpu                   Skip preflight check (true/false, default: false)
* skip-check-obsolete-admin-helper    Skip preflight check (true/false, default: false)
* skip-check-qcow-tool-installed      Skip preflight check (true/false, default: false)
* skip-check-ram                      Skip preflight check (true/false, default: false)
* skip-check-resolver-file-permissions Skip preflight check (true/false, default: false)
* skip-check-root-user                Skip preflight check (true/false, default: false)
* skip-check-supported-cpu-arch       Skip preflight check (true/false, default: false)

Usage:
  crc config SUBCOMMAND [flags]
  crc config [command]

Available Commands:
  get         Get a crc configuration property
  set         Set a crc configuration property
  unset       Unset a crc configuration property
  view        Display all assigned crc configuration properties
```

- Use Console and crc command to view & set advanced properties
- For example to set a new kubeadmin password, use the following
  - crc config set kubeadmin-password admin123

```
[wpernath@biggestmac ~/Devel/openshift-config]$ crc config view
- autostart-tray                        : false
- consent-telemetry                     : no
- cpus                                  : 6
- disk-size                             : 50
- enable-cluster-monitoring             : true
- kubeadmin-password                    : admin123
- memory                                : 32768
- pull-secret-file                      : /Users/wpernath/pull-secret
```

```
[wpernath@biggestmac ~/Devel/openshift-config]$ crc config set kubeadmin-password admin123
Successfully configured kubeadmin-password to admin123
```

- Depending on your use case, have a look at the Operators section
  - I am typically installing OpenShift Pipelines and OpenShift GitOps Operators to have Tekton and ArgoCD installed
  - You could also install OpenShift Serverless (knative)
  - Or install a better version of PostgreSQL database (Crunchy)
  - You might also need to install Jenkins Operator (CI)
  - Or a Nexus Service (maven proxy repository)
- See next section about Kubernetes Operators.
- Or look and see the Artifact Hub for available Helm Charts



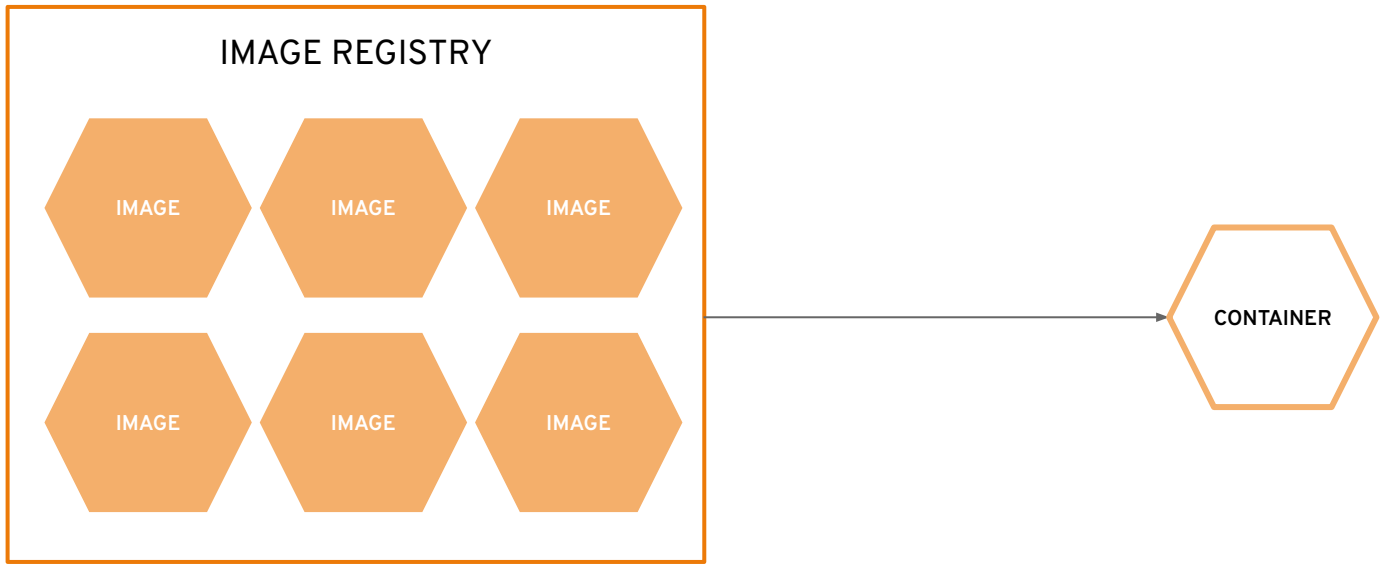
OpenShift and Kubernetes core concepts

Red Hat

a container is the smallest compute unit

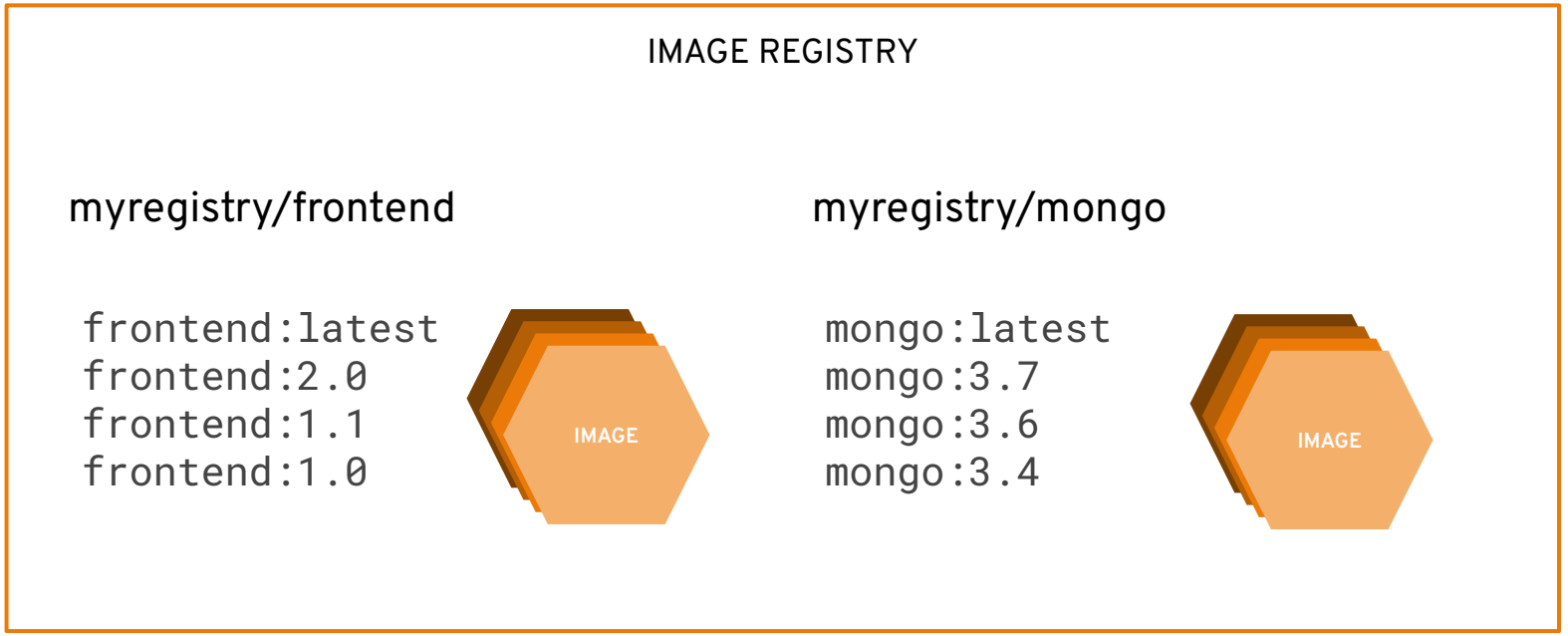
containers are created from container images

container images are stored in an image registry



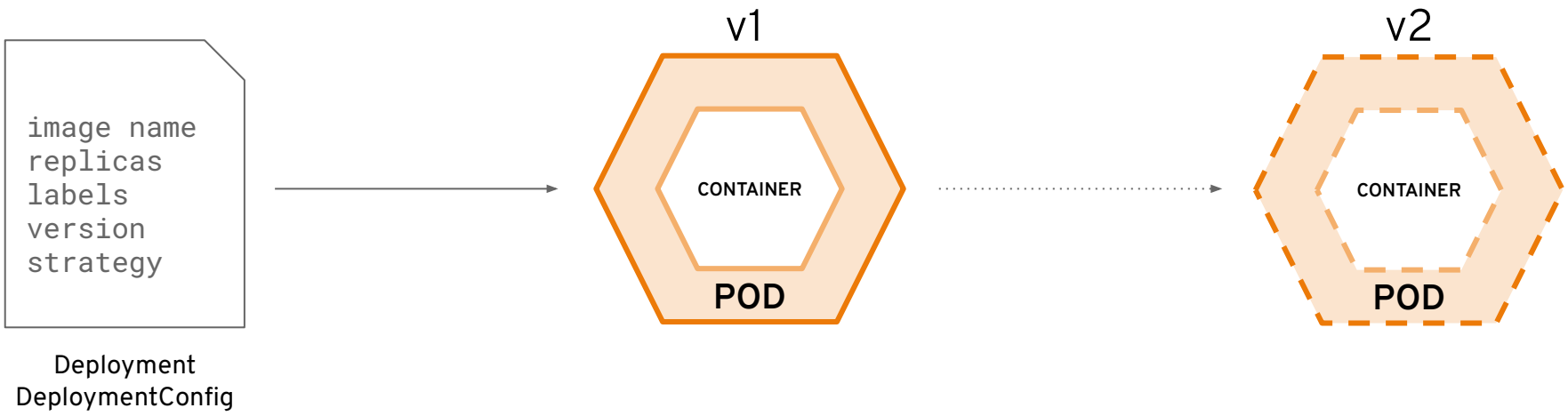
Red Hat

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



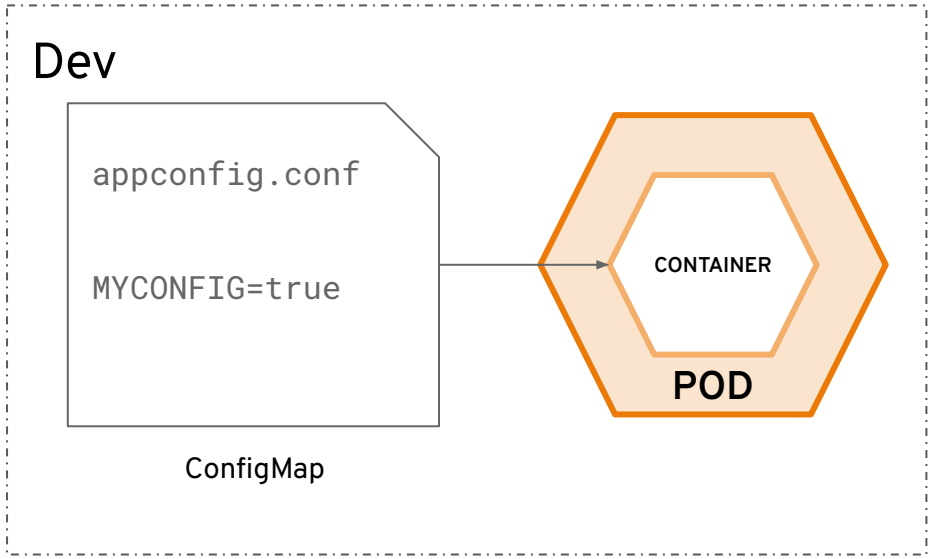
containers are wrapped in pods which are units of deployment and management

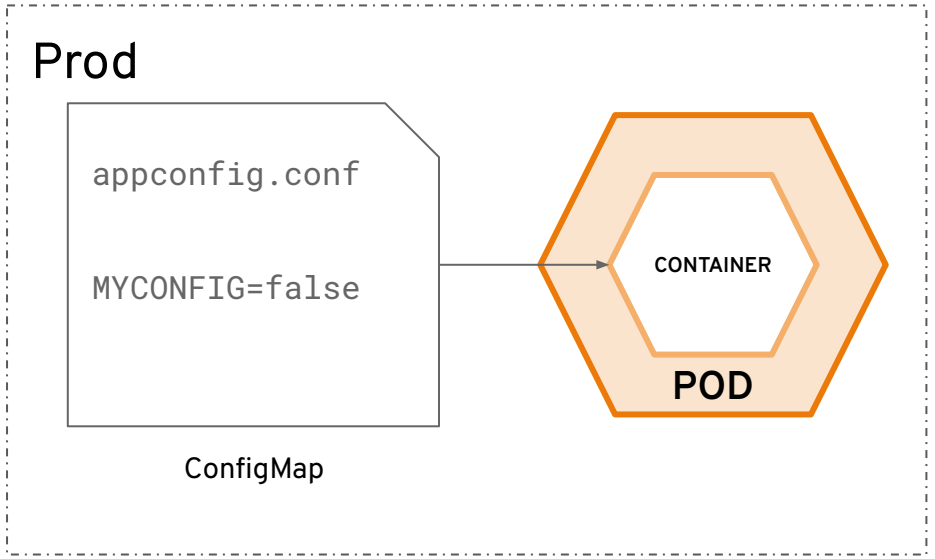
`Deployments` and `DeploymentConfigurations` define how to roll out new versions of Pods



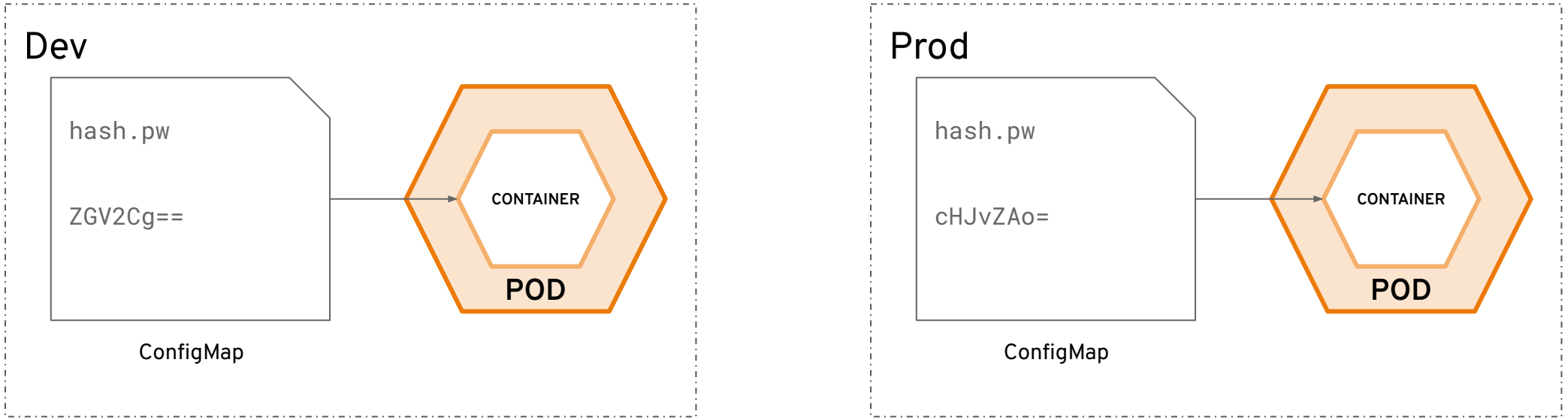
Red Hat

`configmaps` allow you to decouple configuration artifacts from image content



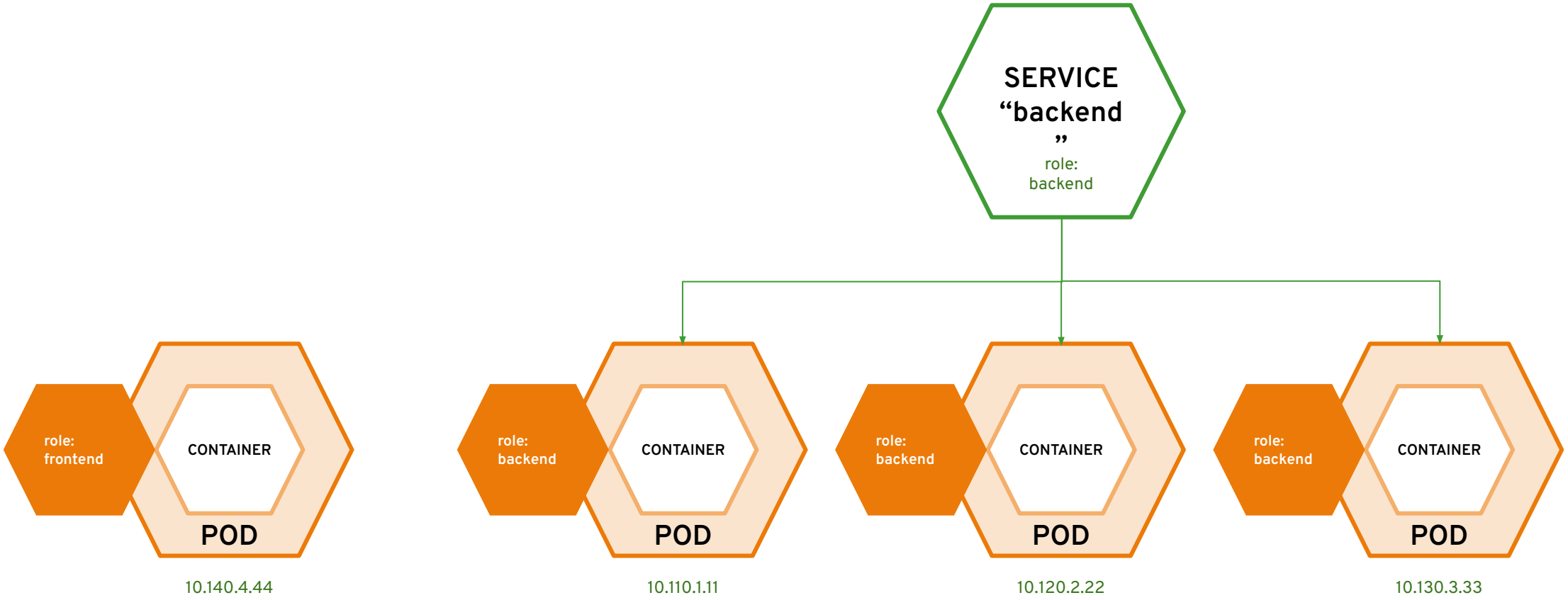


`secrets` provide a mechanism to hold sensitive information such as passwords



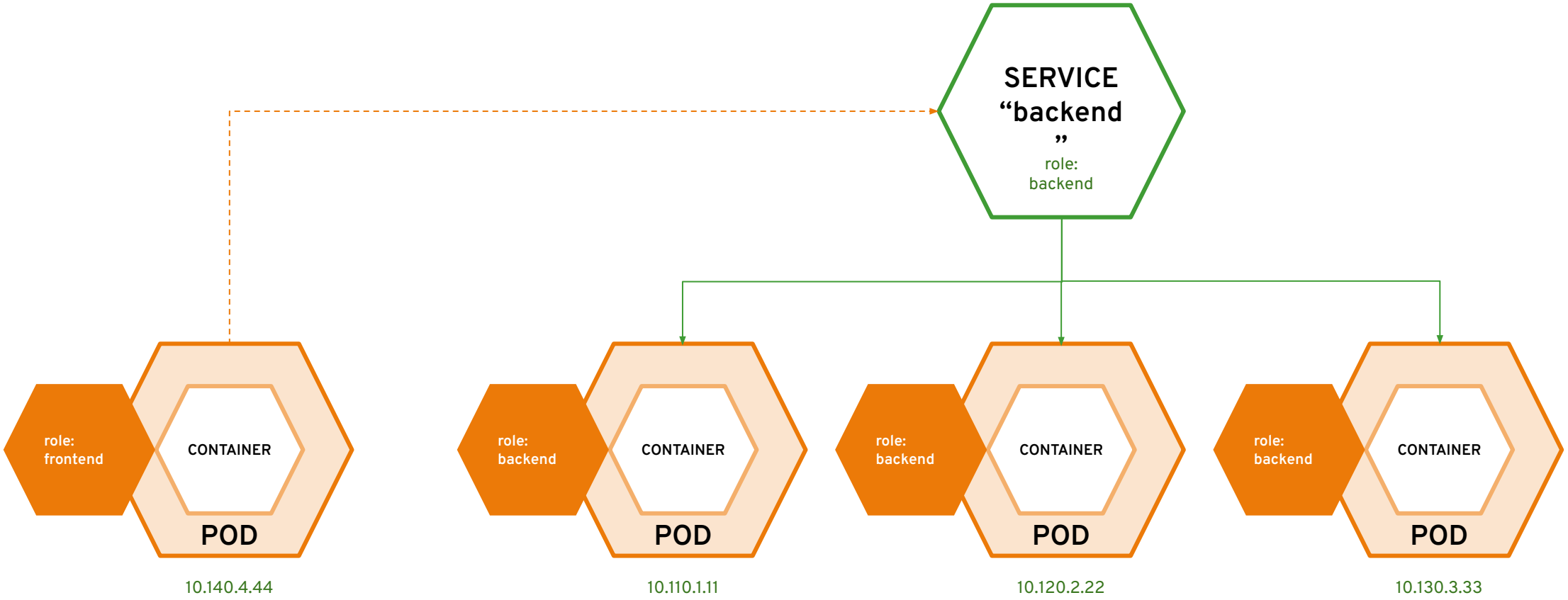
The etcd datastore can be encrypted for additional security
https://docs.openshift.com/container-platform/4.6/security/encrypting-etcd.html

services provide internal load-balancing and service discovery across pods



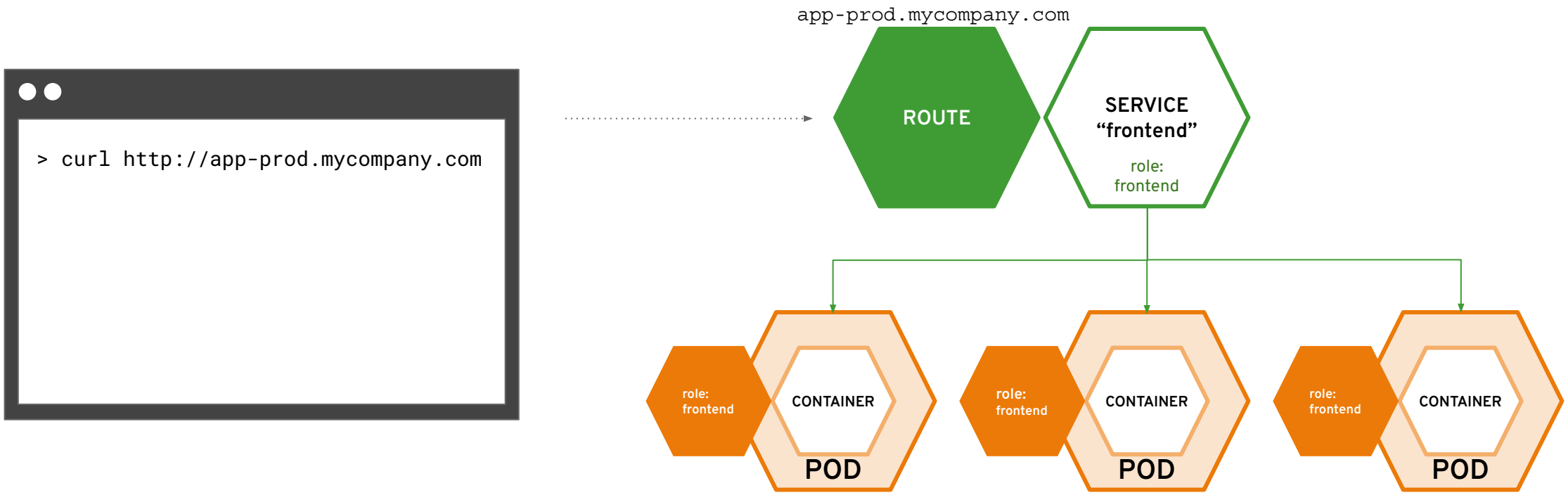
Red Hat

apps can talk to each other via services



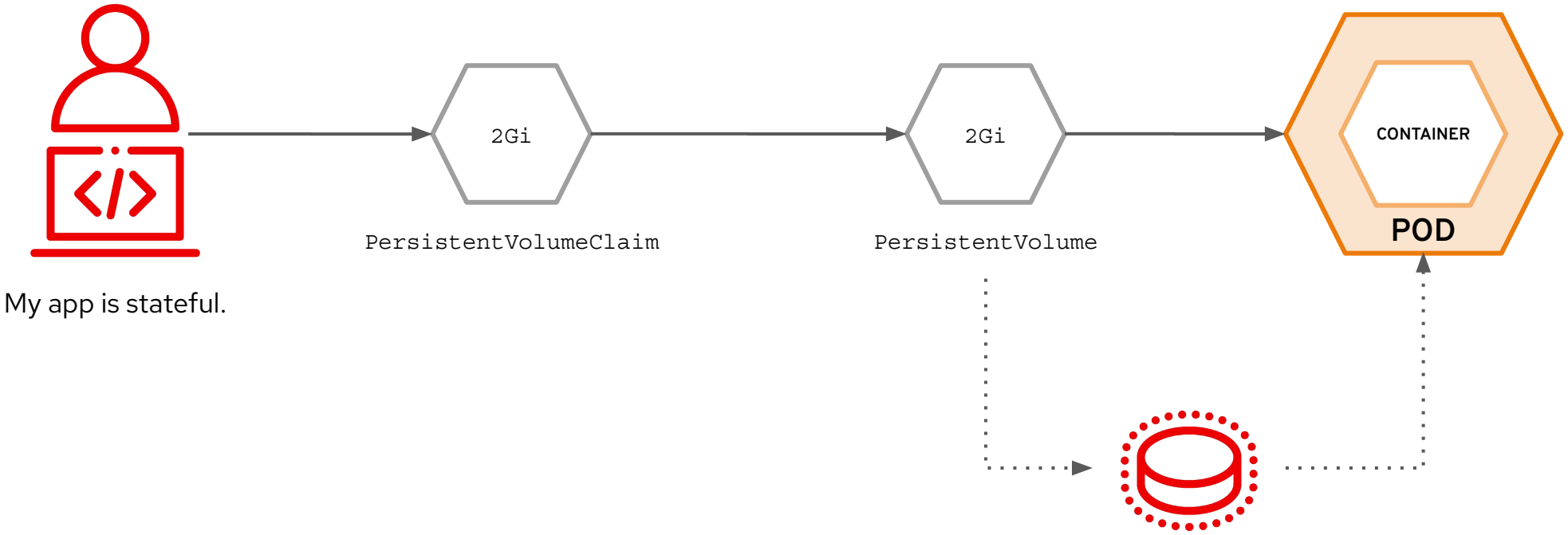
Red Hat

`routes` make services accessible to clients outside the environment via real-world urls

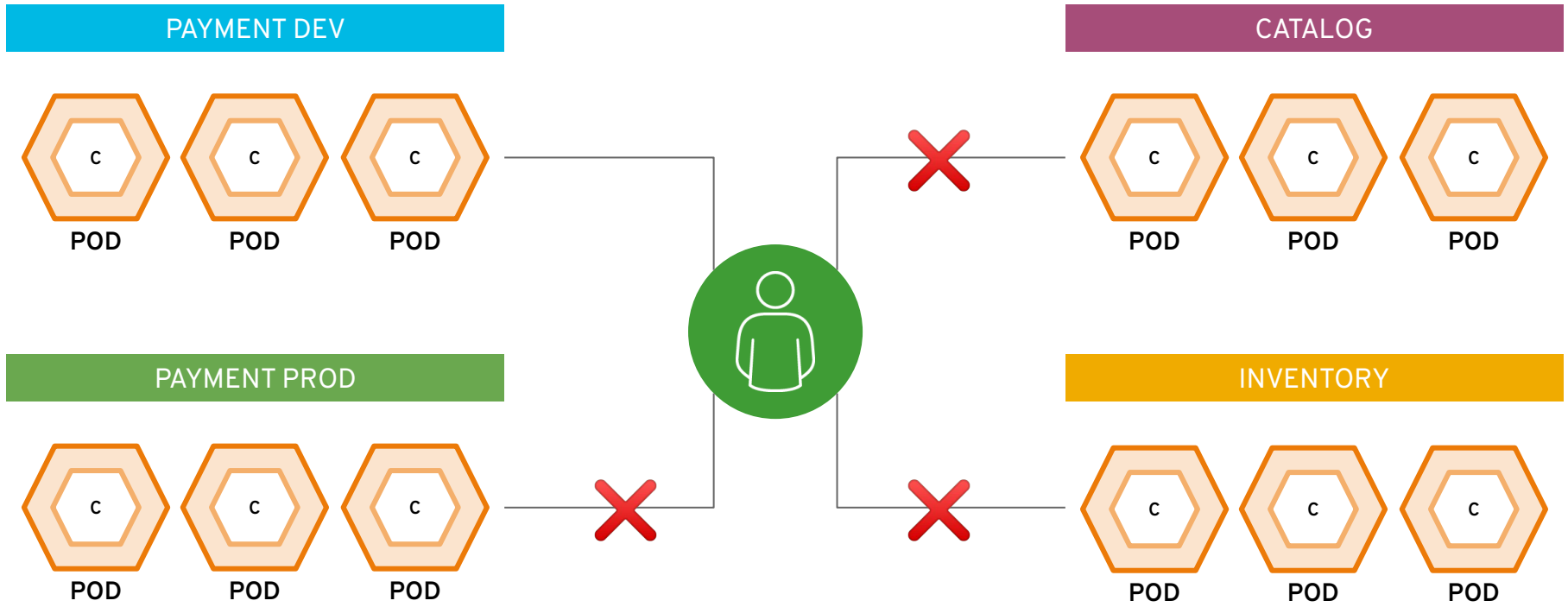


Red Hat

Persistent Volume and Claims



projects isolate apps across environments, teams, groups and departments



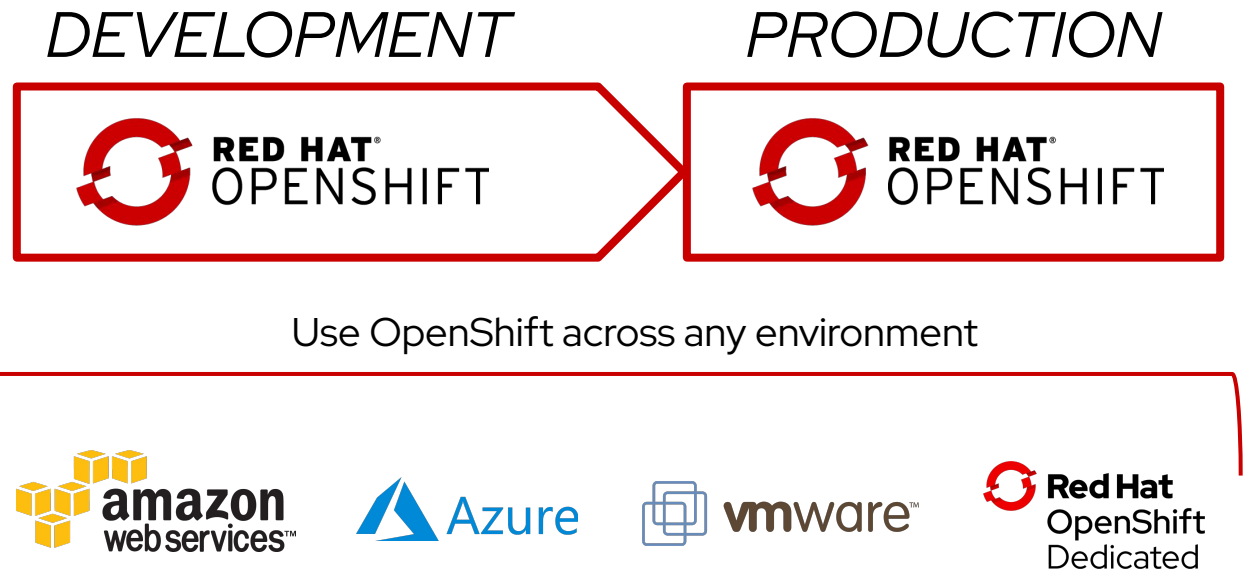
Red Hat

From Code to Image

Staging → Pipelining → GitOps

Please be back 10:15 CET

Red Hat OpenShift
Adds consistency and portability to your cloud journey



*** Develop on OpenShift for existing apps and new cloud-native apps**

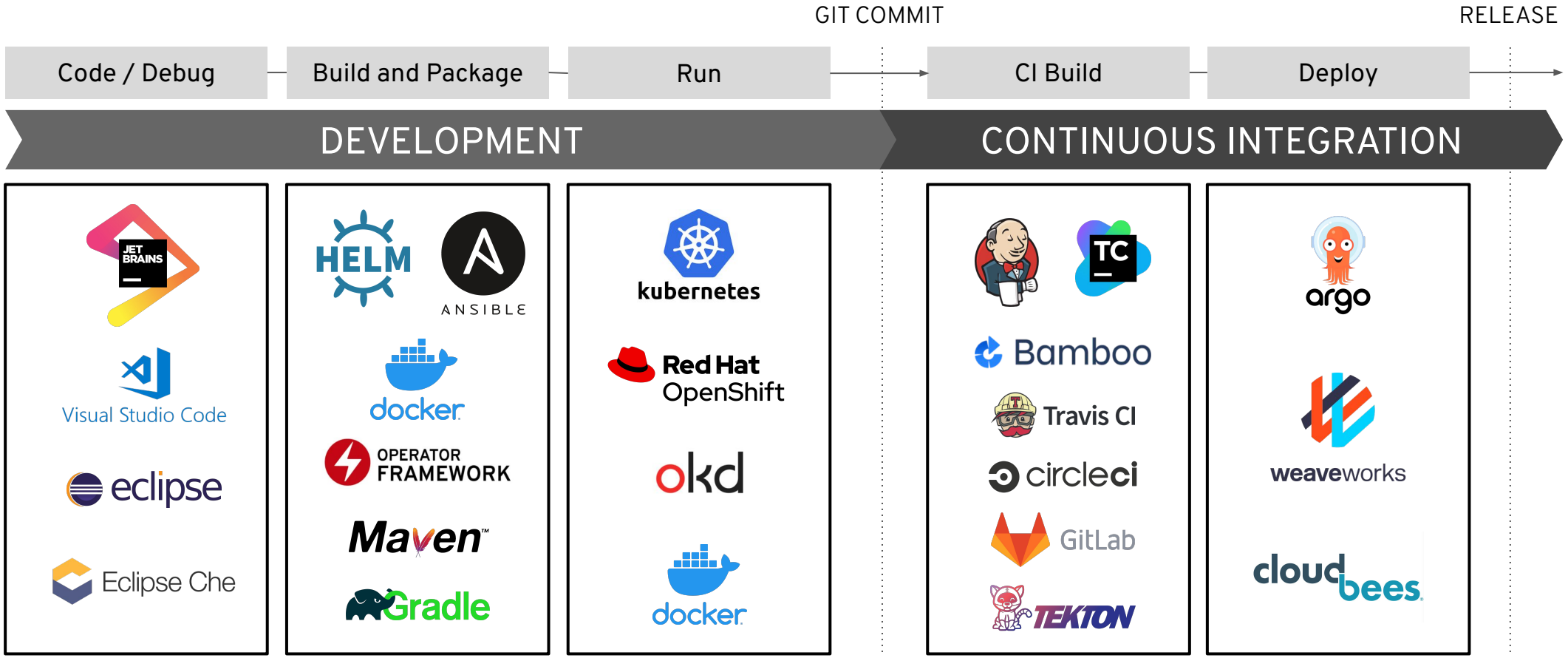
*** Deploy on OpenShift in AWS, Azure, current environments or anywhere else**

One consistent development environment enables developers to move from project to project quickly. They don't need to learn new cloud-specific UIs and tools.

If teams need to leverage other cloud providers at any point it's easy to move specific apps because OpenShift provides an abstraction layer.

Red Hat

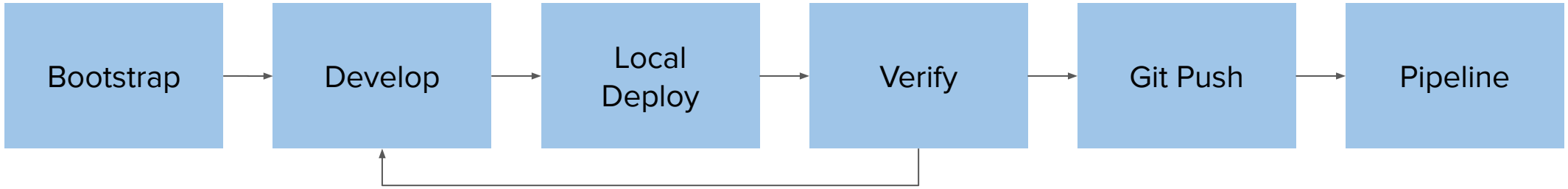
OpenShift integrates into your organization's preferred toolchain



Red Hat

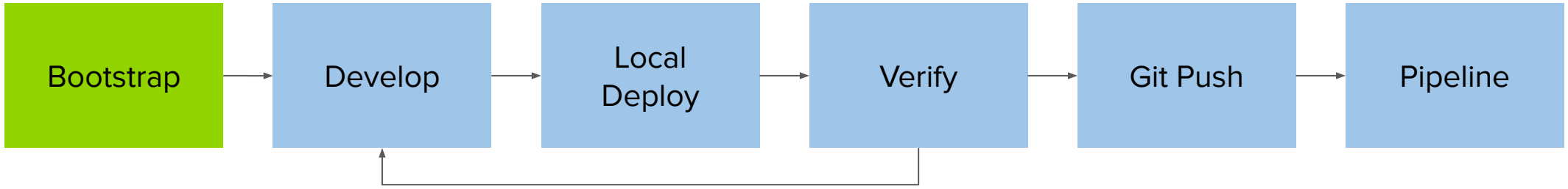
DEVELOPER WORKFLOW

LOCAL DEVELOPMENT WORKFLOW



RED HAT®
OPENSHIFT
Container Platform

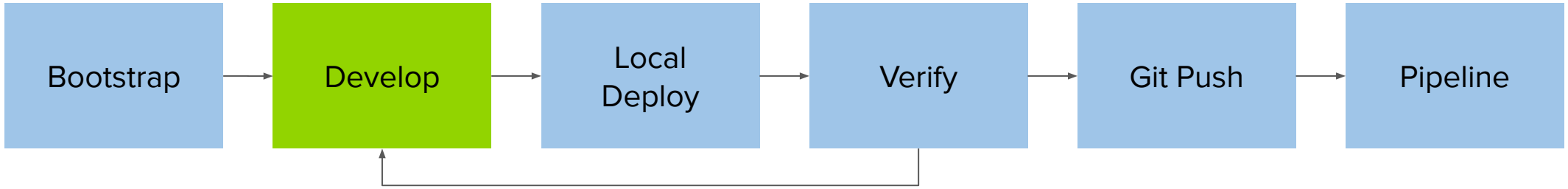
LOCAL DEVELOPMENT WORKFLOW



BOOTSTRAP

- Pick your programming language and application runtime of choice
- Create the project skeleton from scratch or use a generator such as
  - Maven archetypes
  - Quickstarts and Templates
  - OpenShift Generator
  - Spring Initializr

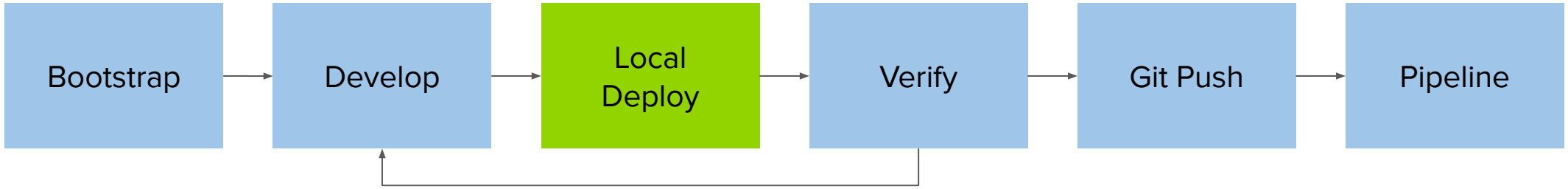
LOCAL DEVELOPMENT WORKFLOW



DEVELOP

- Pick your framework of choice such as Java EE, Spring, Ruby on Rails, Django, Express, ...
- Develop your application code using your editor or IDE of choice
- Build and test your application code locally using your build tools
- Create or generate OpenShift templates or Kubernetes objects

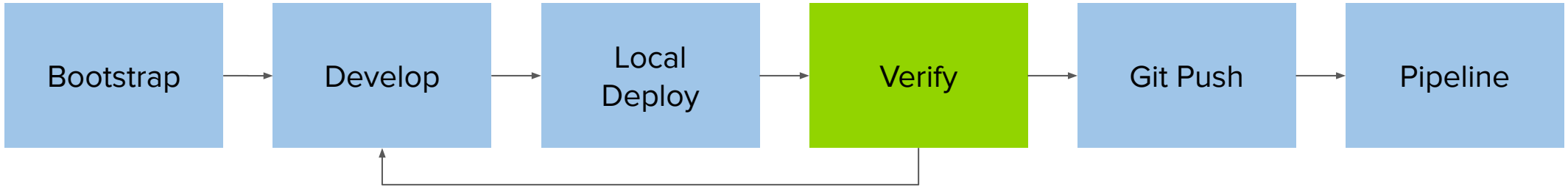
LOCAL DEVELOPMENT WORKFLOW



LOCAL DEPLOY

- Deploy your code on a local OpenShift cluster
- CodeReady Containers / SNO / microshift
- Use binary deploy, maven or CLI rsync to push code or app binary directly into containers

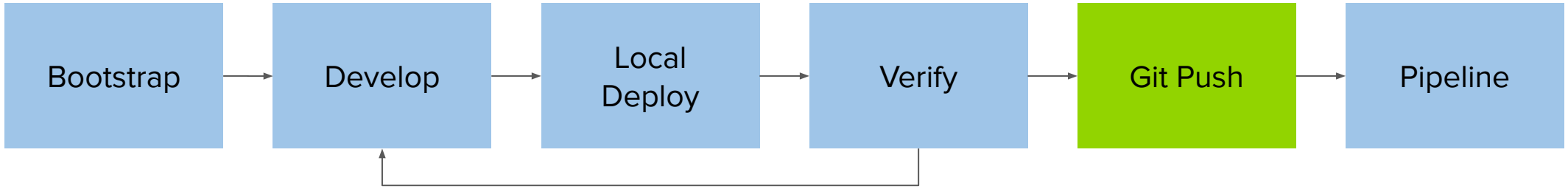
LOCAL DEVELOPMENT WORKFLOW



VERIFY

- Verify your code is working as expected
- Run any type of tests that are required with or without other components (database, etc)
- Based on the test results, change code, deploy, verify and repeat

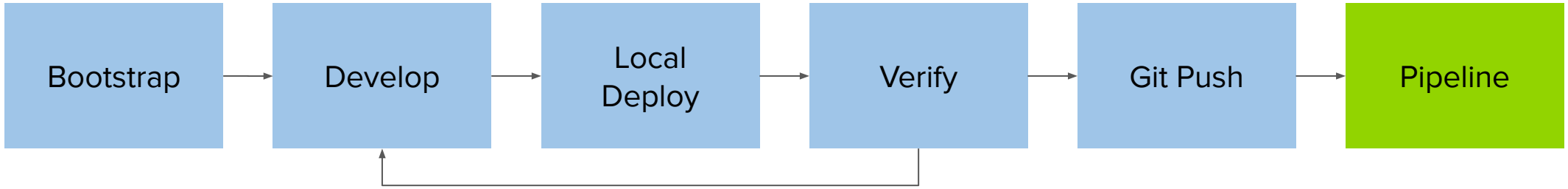
LOCAL DEVELOPMENT WORKFLOW



GIT PUSH

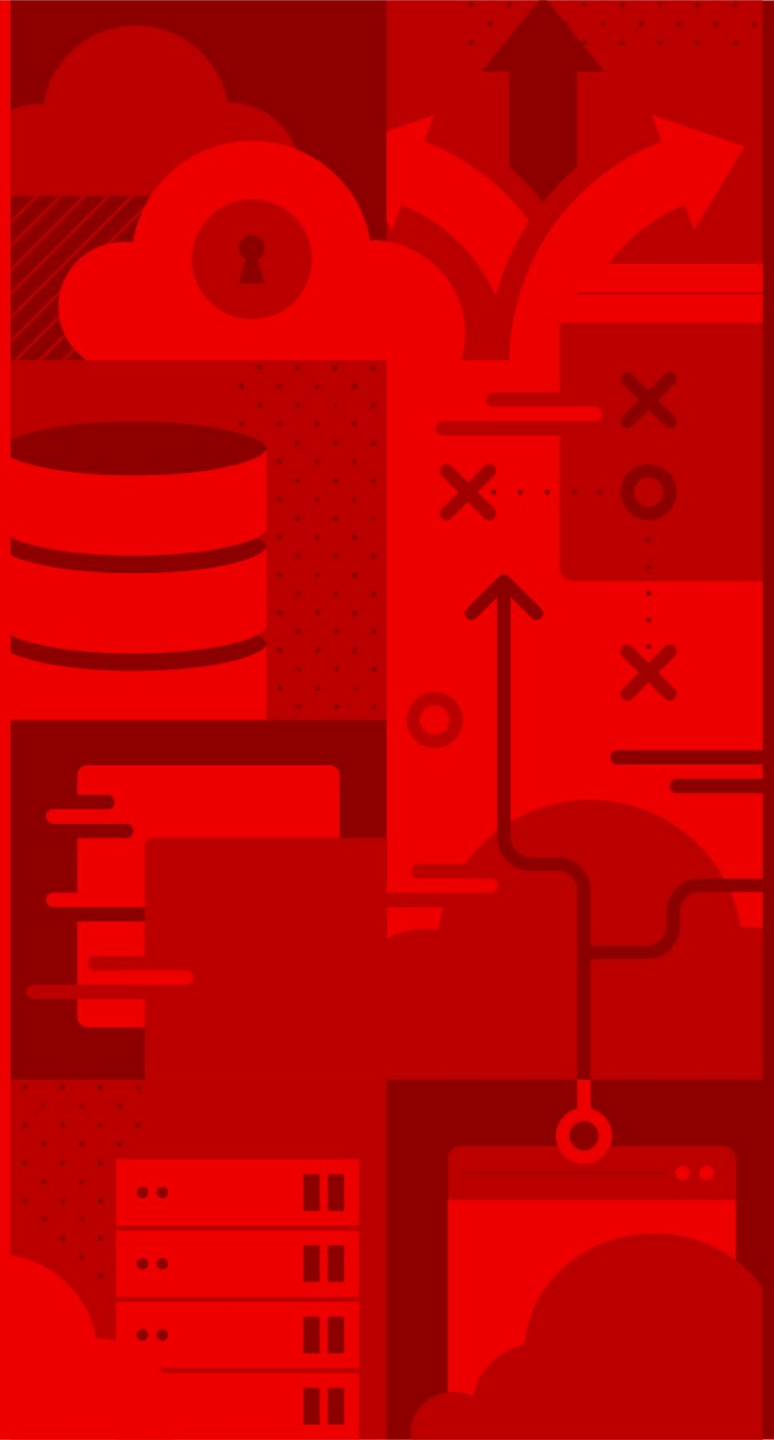
- Push the code and configuration to the Git repository
- If using Fork & Pull Request workflow, create a Pull Request
- If using code review workflow, participate in code review discussions

LOCAL DEVELOPMENT WORKFLOW



PIPELINE

- Pushing code to the Git repository triggers one or multiple deployment pipelines
- Design your pipelines based on your development workflow e.g. test the pull request
- Failure in the pipeline? Go back to the code and start again



What are Helm Charts?

What

- Helm originally invented in 2015 and introduced later that year at KubeCon
- Helm moved as Kubernetes subproject in 2016 as Helm 2.0
- Helm 3.x is now (since 2020) an official CNCF project
- Helm is THE package manager for Kubernetes Applications
    - Helm is like RPM / APT for Linux
    - Or maven / npm for Java / node.js
- Helm Charts can easily be created, installed into a Kubernetes Cluster and also being upgraded
- With the Artifact Hub you have a huge repository of available community driven and maintained charts for every need

Can I use it?

- Short answer: Of course, but mainly for distributing your app!
- Longer answer: If you have an app release and you have to make it available for others, create a Helm Chart for it and make it easy for your customers (regardless of internal or external) to consume it
  - If you are just looking for a way to move your app from one stage to the other, have a look at Templates or kustomize.io
  - Helm and ArtifactHub are a great resource to look at for components you might need

When to use Helm Charts

- Well used for distribution of Applications
- Internal distribution & external
- Not so great for use within CI/CD (but possible, of course)

Drawbacks?

- Learning curve of Helm Charts is steep at the beginning
- It adds another level of complexity to your app development cycle
- Client is a templating engine with its own DSL and complexity
- Helm is intended for Day-1 Operations
- Helm is intended for stateless application distribution

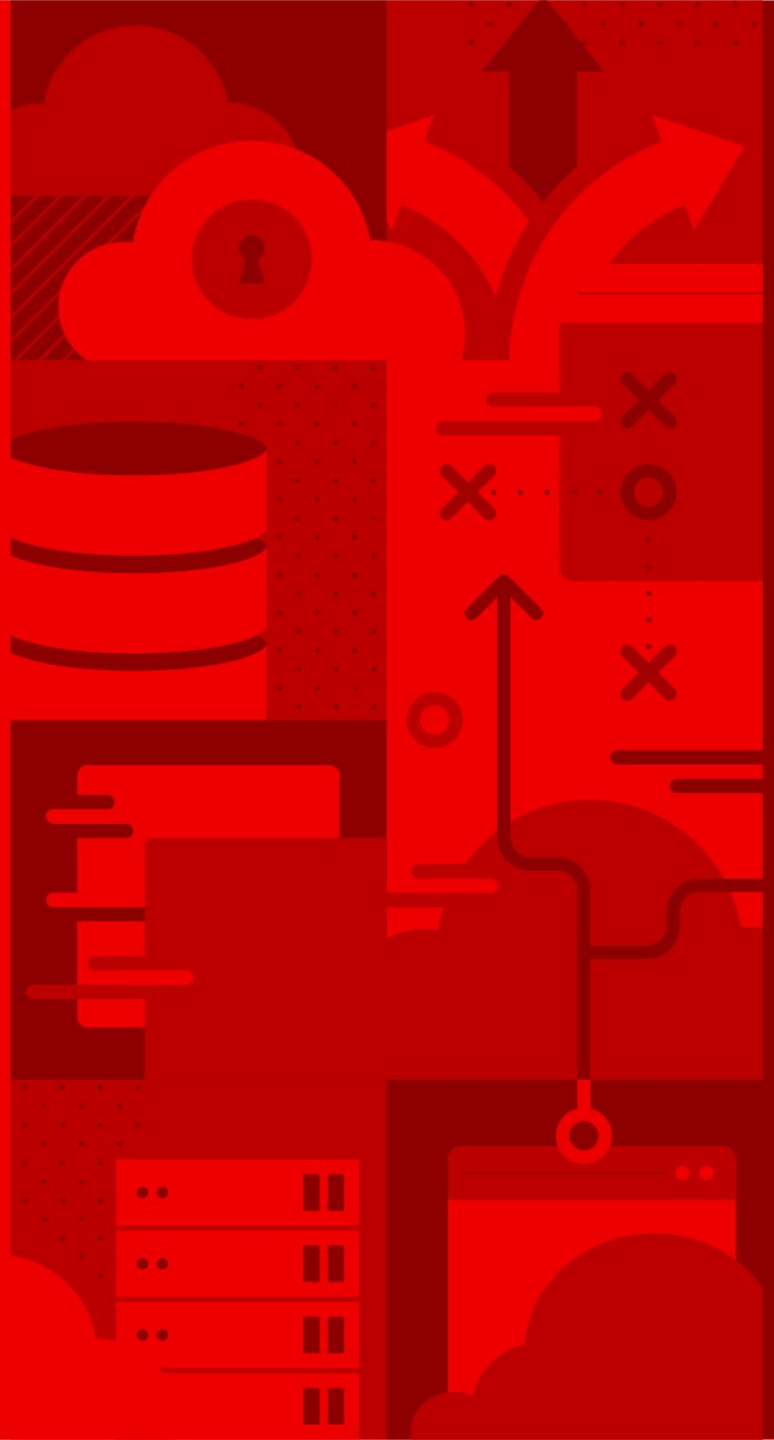
Helm 2 vs 3

- Helm 2 required a server component called Tiller
  - Another app on top of kubernetes which had to be managed and maintained
  - Tiller had its own RBAC and its own audit trail
  - Tiller was storing sensitive data in ConfigMaps
  - → Loss of visibility
- Helm 3 does not need a server side component
  - It uses native kubernetes approach and only a client side tool

- **⇒ This is the reason why OpenShift did not natively support Helm prior V3**

Resources

- Helm.sh
- Spotlight on Helm
- To Helm or not?. Helm is becoming a very popular tool to... | by Stepan | FAUN
- From Templates to Openshift Helm Charts
- Working with Helm charts using the Developer perspective - Application life cycle management | Applications | OpenShift Container Platform 4.6
- How to make a Helm chart in 10 minutes
- Artifact Hub
- https://github.com/wpernath/helm-demo.git
- Automated Application Packaging And Distribution with OpenShift - Part 2/3 – Open Sourcerers



What are Kubernetes Operators?

Red Hat

What

- Operators were originally invented in 2018 by CoreOS as a way to extend kubernetes by adding new custom resources and controllers or to help human operators to operate and manage stateful applications on kubernetes
- Operators are part of the kubernetes project
- Operators are like Helm Charts a way to distribute your app
- Operators contain all the domain logic required to manage the app
    - It understands how to scale up / down a stateful app
    - It understands how to do backups
- Operators are packaged as a mix of yaml definitions and a standard language like Go, Java etc.
- OperatorHub.io contains a nice set of available operators
- OperatorSDK helps you to create an own operator

Wait... stateless / stateful?

- Stateless
  - Kubernetes can manage stateless apps easily
  - Scaling is just a matter of adding a new pod
- Stateful
  - Imagine a mysql database
  - Scaling that up, means kubernetes is creating copies of the data
  - In fact, you then would have 3 different DBs
  - You need to find a way to properly scale mysql
  - Every app handles that differently (mysql vs. postgres vs. redis)
  - That domain logic needs to be put into an Operator to automate those tasks

Can I use it?

- Short answer: Of course!
- Longer answer:
  - Whenever you need to find a way to tell kubernetes how to manage your stateful complex app, you have to use Operators.
  - If your app is stateless or does not need special treatment, don't use Operators, think about Helm Charts then

Drawbacks?

- Quite complex
- You need to understand kubernetes properly

Resources

- OperatorHub.io | The registry for Kubernetes Operators
- Operators on Red Hat OpenShift
- Operator SDK
- An intro to Kubernetes operators
- Kubernetes Operator simply explained in 10 mins

CI/CD with OpenShift

Basics

Wouldn’t it be great, if everything could be automated?

Wouldn’t it be great, if we simply do <insert hype here> and it solves all problems we have?

With DevOps we have a principle which solves most of the issues - but wait! The *DevOps Person* of the customer is currently on vacation


WE DO DEVOPS ALREADY
JUST WITHOUT AGILE, STANDUPS, CI, CODE OR ANY OF THAT OTHER HIPSTER STUFF
memes.com

Basics - Developer

- Important: Separation of code and config!
- Writes the code of the App
- Writes set of build files (maven, gradle, etc.)
- Writes all needed tests (unit, integration, load)
- Writes Pipeline files
- Writes kubernetes manifest files
- Stores everything auditable in Git
- Finds a way and tools to combine all of the above

Basics - Operations

- Gets images, configs, test descriptions from Devs
- Adds own kubernetes manifests to the soup
- Makes sure, everything gets deployed
- Makes sure every dependency is installed and ready
- Thinks about security
- Thinks about networking
- Thinks about storage
- Thinks about compute power
- Thinks about plumbing everything together

Basics

CI/CD

=

Automation of Software Delivery

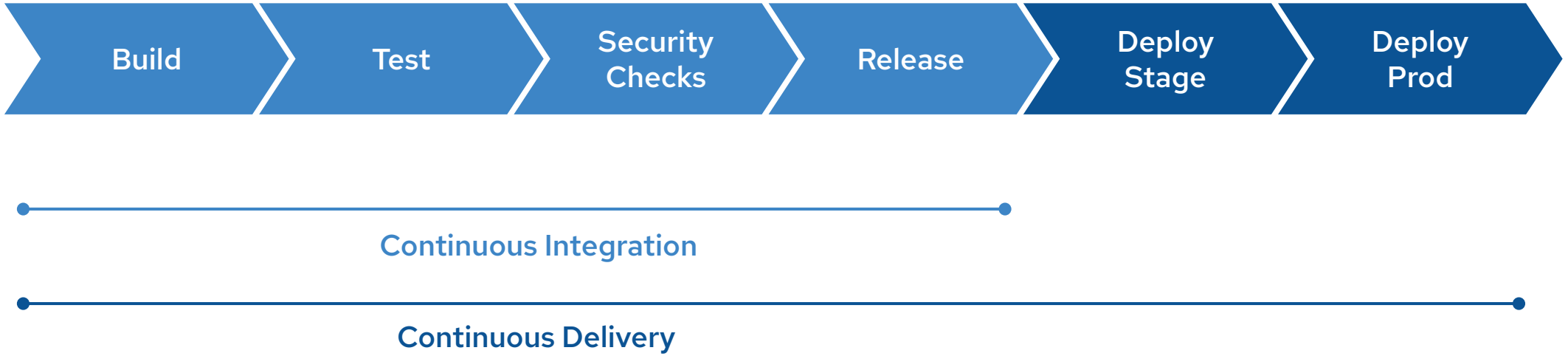
DevOps

=

Let’s have Dev and Ops TALK to each other

Continuous Integration(CI) & Continuous Delivery (CD)

A key DevOps principle for automation, consistency and reliability



Red Hat

Tekton / OpenShift Pipelines

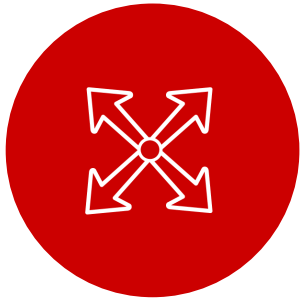
Kubernetes native on demand delivery pipelines

Red Hat

What is Cloud-Native CI/CD?

Containers

Built for container apps and runs on Kubernetes



Serverless

Runs serverless with no CI/CD engine to manage and maintain

DevOps

Designed with microservices and distributed teams in mind

Why Cloud-Native CI/CD?

Traditional CI/CD	Cloud-Native CI/CD
Designed for Virtual Machines	Designed for Containers and Kubernetes
Require IT Ops for CI engine maintenance	Pipeline as a service with no Ops overhead
Plugins shared across CI engine	Pipelines fully isolated from each other
Plugin dependencies with undefined update cycles	Everything lifecycled as container images
No interoperability with Kubernetes resources	Native Kubernetes resources
Admin manages persistence	Platform manages persistence
Config baked into CI engine container	Configured via Kubernetes ConfigMaps

Why Cloud-Native CI/CD?

Traditional CI/CD	Cloud-Native CI/CD
Designed for Virtual Machines	Designed for Containers and Kubernetes
Require IT Ops for CI engine maintenance	Pipeline as a service with no Ops overheard
Plugins shared across CI engine	Pipelines fully isolated from each other
Plugin dependencies with undefined update cycles	Evergreen library of maintained images
No interoperability with Kubernetes resources	Native Kubernetes resources
Admin manages persistence	Platform manages persistence
Config baked into CI engine container	Configured via Kubernetes ConfigMaps

Jenkins

TEKTON

OpenShift Pipelines

Built for Kubernetes

Cloud-native pipelines taking advantage of Kubernetes execution and , operational model and concepts

Scale on-demand

Pipelines run and scale on-demand in isolated containers, with repeatable and predictable outcomes

Secure pipeline execution

Kubernetes RBAC and security model ensures security consistently across pipelines and workloads

Flexible and powerful

Granular control over pipeline execution details on Kubernetes, to support your exact requirements

Powered by 

Red Hat

An open-source project for providing a set of shared and standard components for building Kubernetes-style CI/CD systems

Governed by the Continuous Delivery Foundation

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

Red Hat

OpenShift GitOps

Declarative GitOps for multi-cluster continuous delivery

Red Hat

What is GitOps?

GitOps is when the infrastructure and / or application state is fully represented by the contents of a git repository. Any changes to the repository are reflected in the corresponding state of the associated infrastructure and applications through automation

GitOps is a natural evolution of Agile and DevOps (and Kubernetes) methodologies

Why GitOps

It takes too long to provision a new environment!

The app behaves different in prod than in test!

Environments are all manually configured!!!

Production deployments have a low success rate!

I have no visibility or record of config changes in deployments!

I can't audit config changes!!

I can't easily rollback changes to a specific version

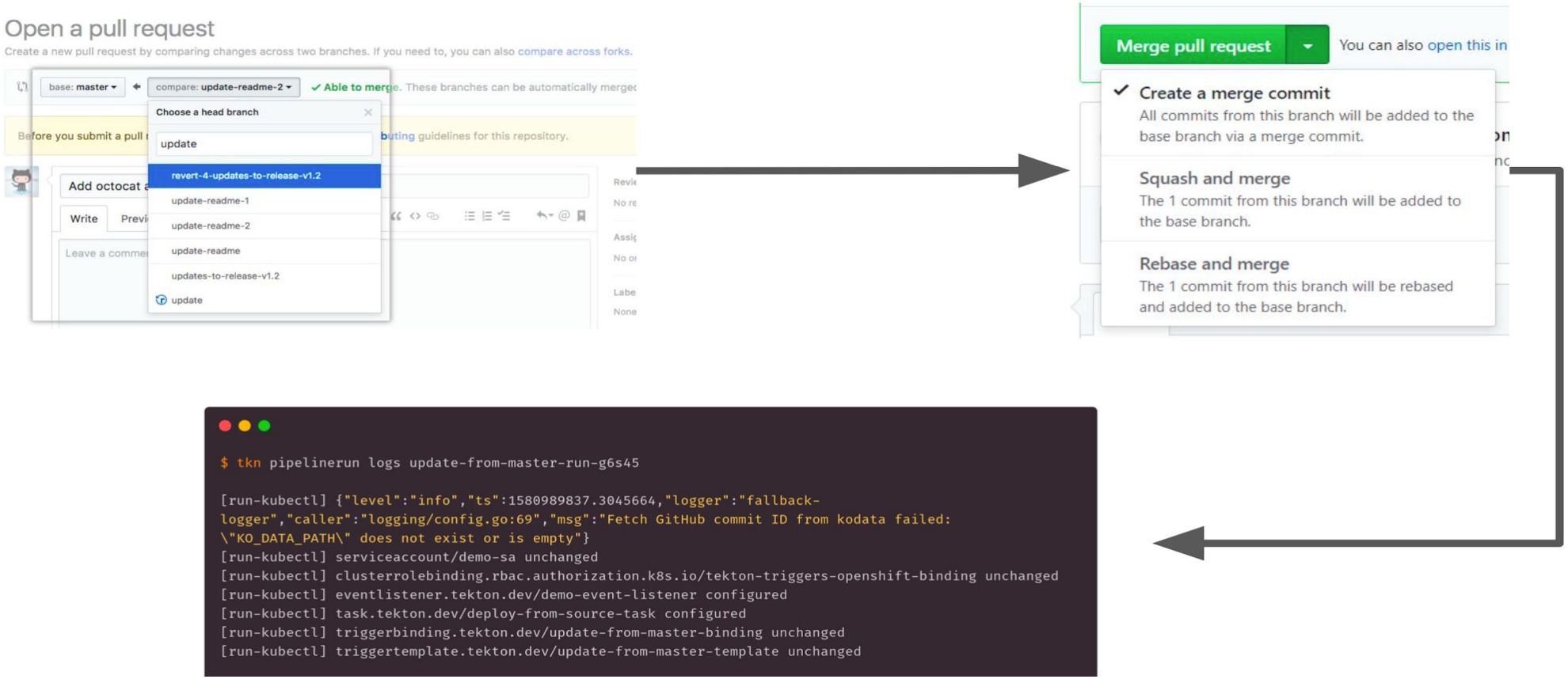
GitOps Benefits

- All changes are auditable
- Standard roll-forward or backwards in the event of failure
- Disaster recovery is “reapply the current state of the manifests”
- Experience is “pushes and pull-requests”

OpenShift and GitOps - A great match

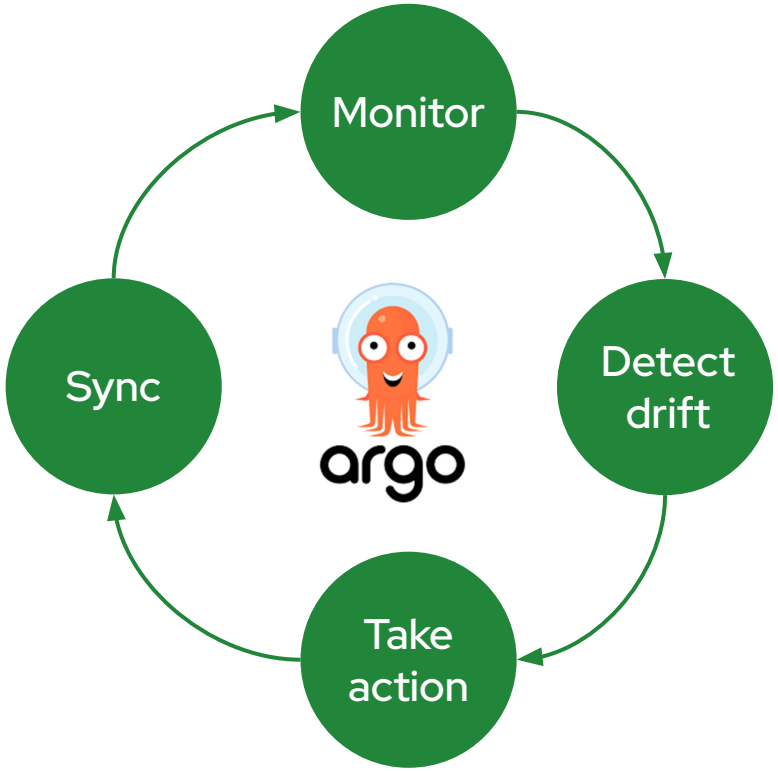
- OpenShift is a declarative environment
  - Cluster configuration is declared and Operators make it happen
  - Application deployments are declared and Kubernetes scheduler makes it happen
- GitOps in traditional environments requires automation/scripting, declarative environment minimizes or eliminates this need
- Declarations are yaml files which are easily stored and managed in git

Day 2 operations: All changes triggered from Git

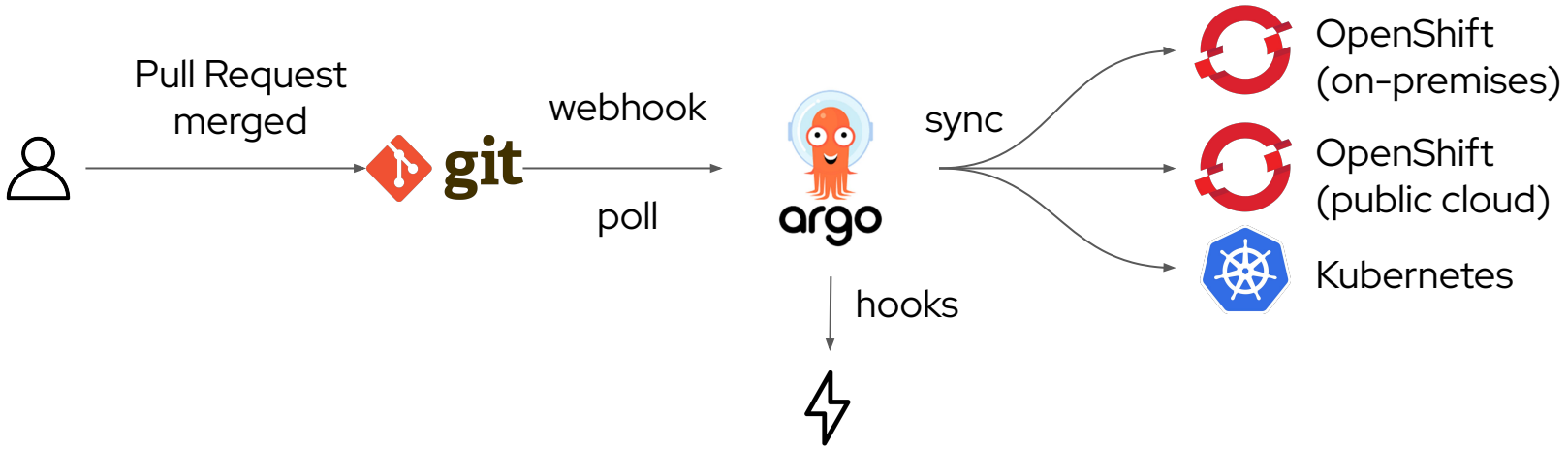


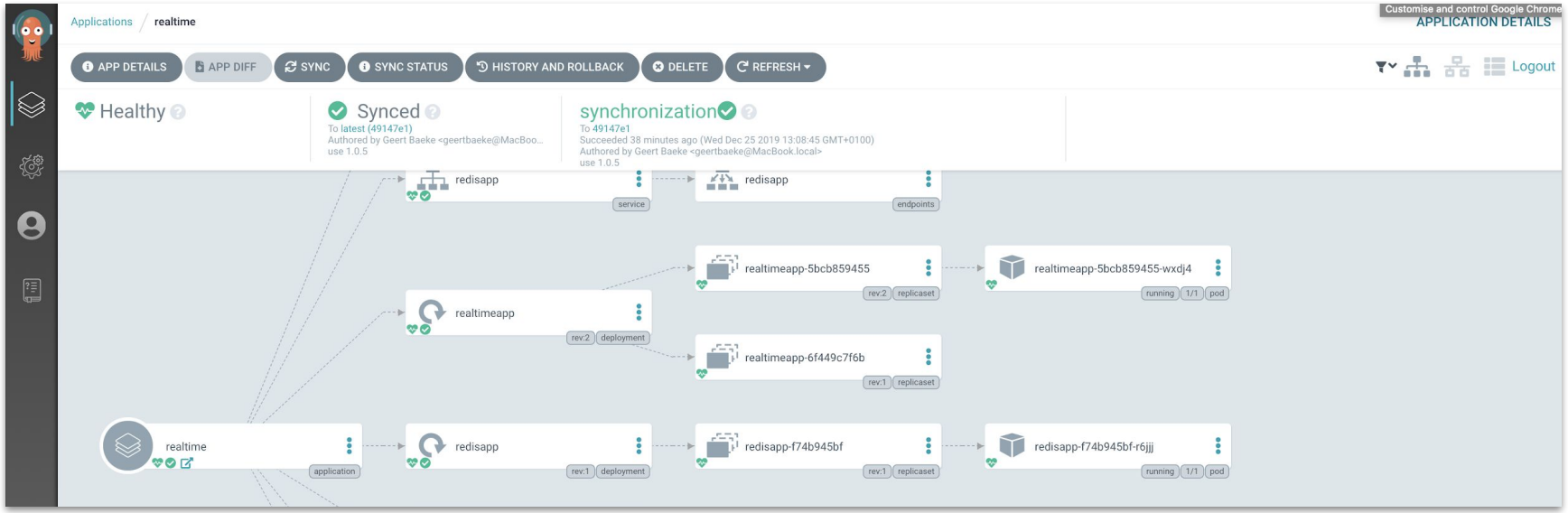
Argo CD

- Cluster and application configuration versioned in Git
- Automatically syncs configuration from Git to clusters
- Drift detection, visualization and correction
- Granular control over sync order for complex rollouts
- Rollback and rollforward to any Git commit
- Manifest templating support (Helm, Kustomize, etc)
- Visual insight into sync status and history



Argo CD



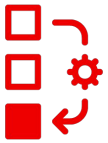


Red Hat

OpenShift GitOps

Multi-cluster config management

Declaratively manage cluster and application configurations across multi-cluster OpenShift and Kubernetes infrastructure with Argo CD



Automated Argo CD install and upgrade

Automated install, configurations and upgrade of Argo CD through OperatorHub

Opinionated GitOps bootstrapping

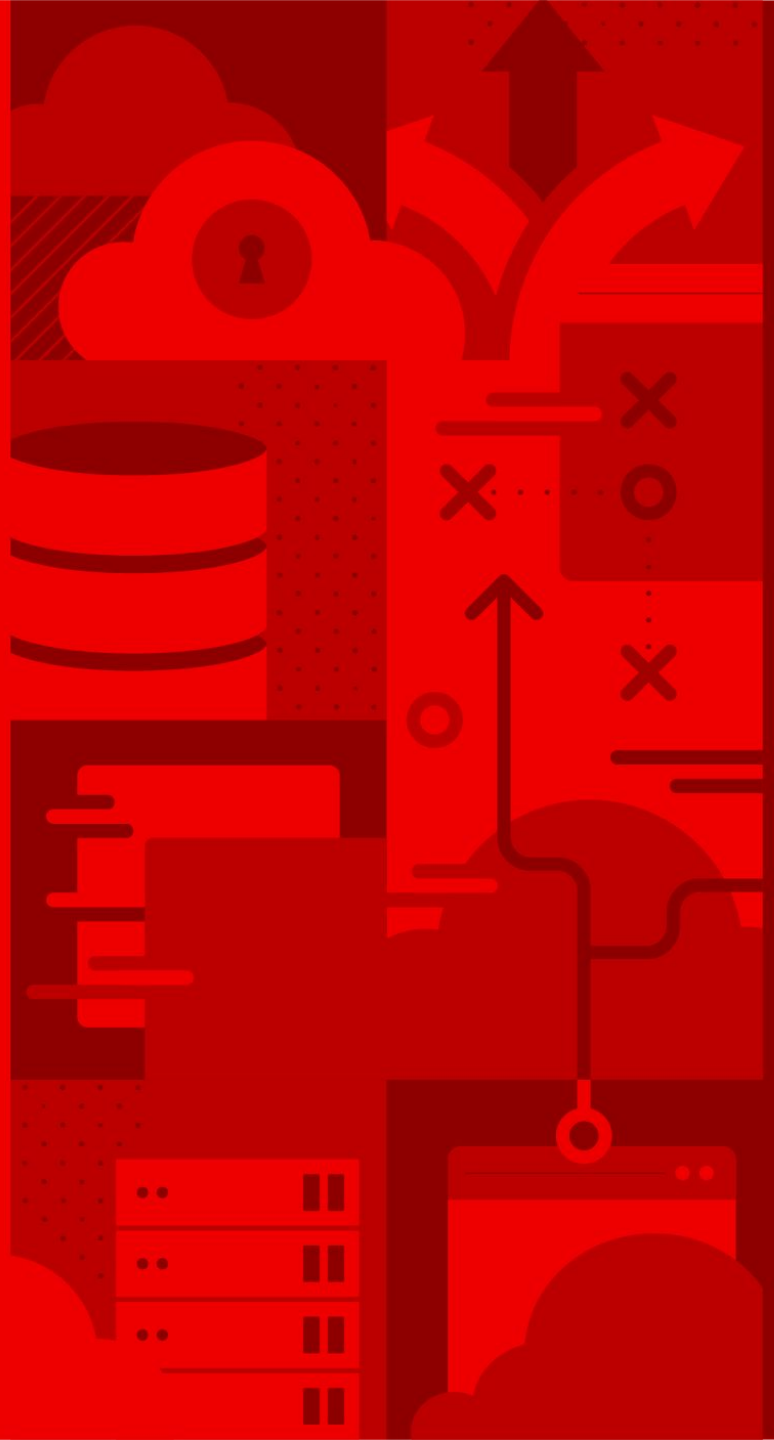
Bootstrap end-to-end GitOps workflows for application delivery using Argo CD and Tekton with GitOps Application Manager CLI

Deployments and environments insights

Visibility into application deployments across environments and the history of deployments in the OpenShift Console

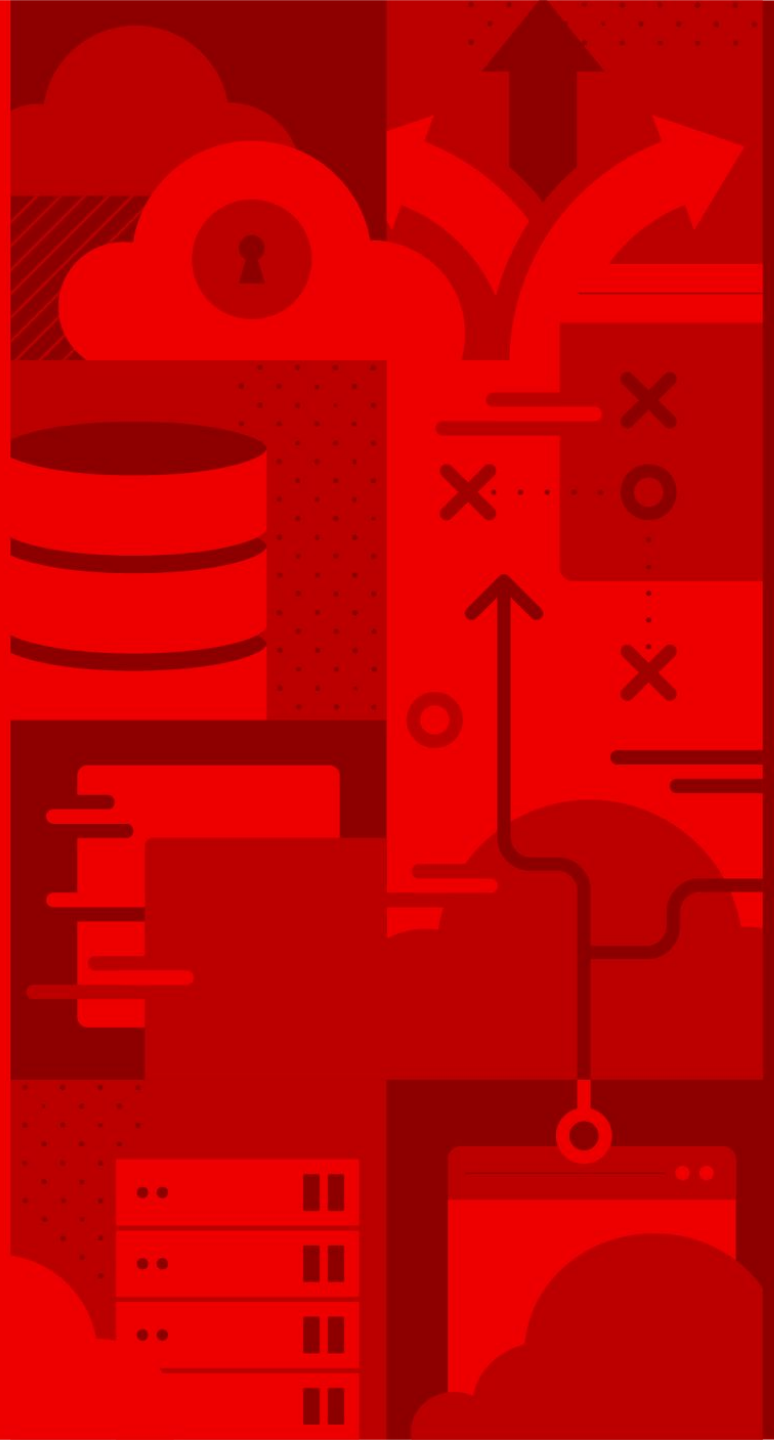
Powered by argo

Red Hat



Demo

Red Hat



Further reading and resources...

OpenShift for Developers and CI/CD explained:

- Automated Application Packaging and Distribution with OpenShift - Basic Development - Part 1/4 – Open Sourcerers
- Automated Application Packaging And Distribution with OpenShift - Helm Charts and Operators - Part 2/4 – Open Sourcerers
- Automated Application Packaging And Distribution with OpenShift - Tekton Pipelines - Part 3/4 – Open Sourcerers

Thank you !