// CODE CLUSTER: BOOSTING DEVELOPMENT WITH A LOCAL KUBERNETES OPS PLATFORM



Yannick Christian Thomas, Johannes Schnatterer Cloudogu GmbH



in in/yannickchristhomas



@ @schnatterer@floss.social



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What is your profession?

Software Engineer / Developer



What is your profession?

Platform Engineer / Ops person



Who uses Kubernetes for local development?

k3d Minkube Microk8s k3s KIND

Docker DesktopkOs Rancher Desktop



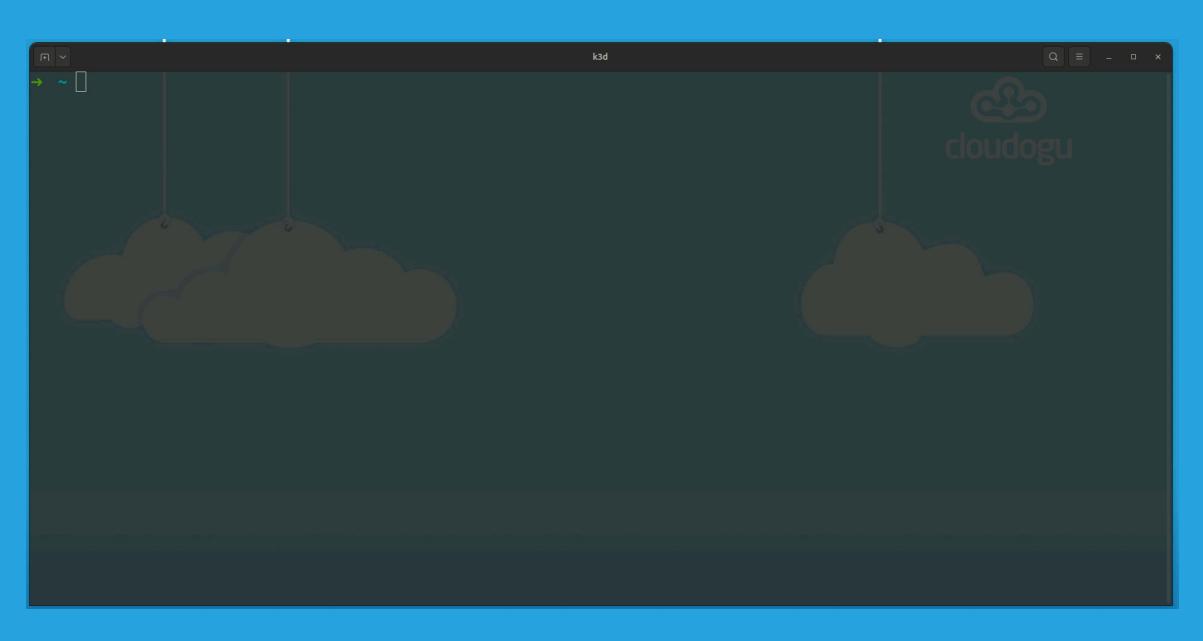
Kubernetes is a platform for building platforms. It's a better place to start; not the endgame.

10:04 PM · Nov 27, 2017

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twitter.com/kelseyhightower/status/935252923721793536

Start a local k8s cluster with one command



Next, start the platform









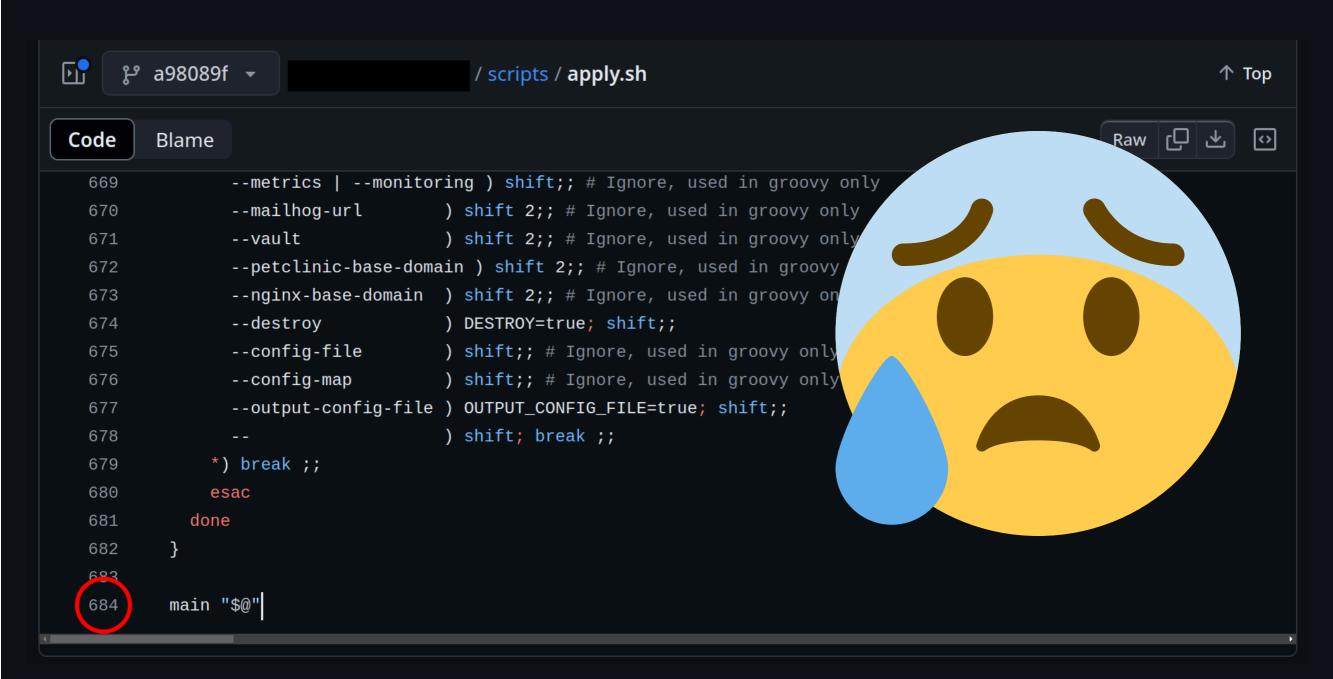








So, let's write a little script...



Why not start the platform with one command?

Meet GOP

a GitOps-based operational stack (platform)











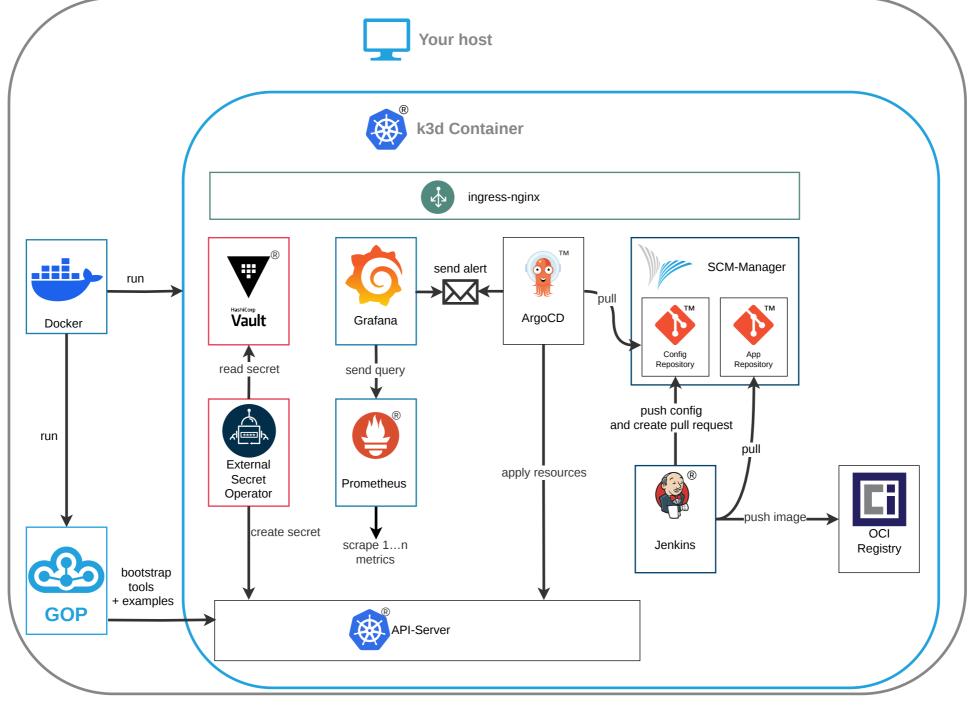
```
COMMIT='42e5f80'
bash <(curl -s \
  "https://raw.githubusercontent.com/cloudogu/gitops-playground/$COMMIT/scripts/init-cluster.sh") \
  --bind-ingress-port=80 \
   && docker run --rm -t -u (id -u) \setminus
    -v ~/.config/k3d/kubeconfig-gitops-playground.yaml:/home/.kube/config \
    --net=host \
    ghcr.io/cloudogu/gitops-playground:$COMMIT --yes --base-url=http://localhost --ingress-nginx \
      --argord --monitoring --vault=dev --mailhog
```

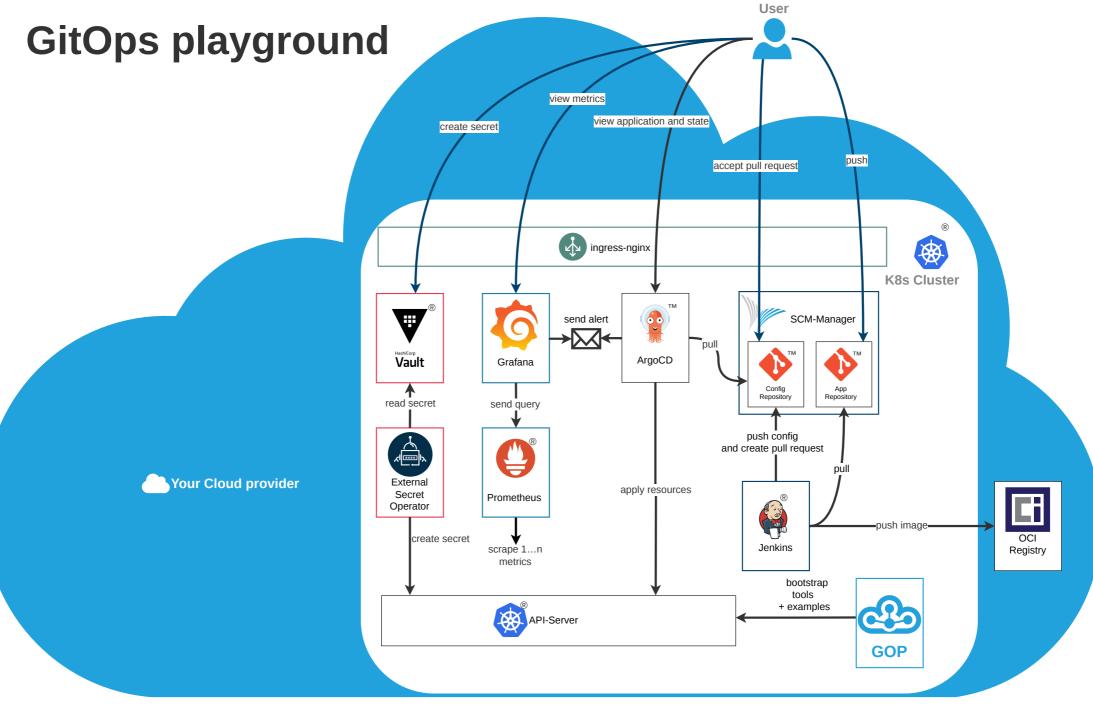
Cloudogu/gitops-playground

k3d hints

```
# Cleanup
k3d cluster rm gitops-playground

# Pause to save resources
k3d cluster stop gitops-playground
# Continue
k3d cluster start gitops-playground
```





scripts/init-cluster.sh

```
k3d cluster create gitops-playground \
  # Mount port for ingress
  -p 80:80@server:0:direct \
  # Pin image for reproducibility
  --image=rancher/k3s:v1.29.1-k3s2 \
  # Disable built-in ingress controller, because we want to use the same one locally and in prod
  --k3s-arg=--disable=traefik@server:0 \
  # Allow node ports < 30000
  --k3s-arg=--kube-apiserver-arg=service-node-port-range=8010-65535@server:0 \
  # Hacks to make Docker available in Jenkins
  -v /var/run/docker.sock:/var/run/docker.sock@server:0 \
  -v /etc/group:/etc/group@server:0 -v /tmp:/tmp@server:0 \
  -p 30000:30000@server:0:direct
# Write kubeconfig to ~/.config/k3d/kubeconfig-gitops-playground.yaml
k3d kubeconfig write gitops-playground
```

docker run

```
docker run
  # Remove container after running, keeping your device clean
  # (remove in case of error to preserve logs)
  - - rm
  # Colorful output, please
  -t
  # Run as current user, so files written to /tmp are accessible for you
  -u $(id -u) \
  # Mount kubeconfig for k3d
  -v ~/.config/k3d/kubeconfig-gitops-playground.yaml:/home/.kube/config \
  # Make k3d cluster available
  --net=host \
ghcr.io/cloudogu/gitops-playground:$COMMIT #Params for image go here
```

ghcr.io/cloudogu/gitops-playground

OCI image

Εi

- Contains logic to install and configure the tools
- App written in Groovy (and bash ②)

- O Proops
- Additional resources to run e.g. in air-gapped envs



Your turn



iphy.com/gifs/JIX9t2j0ZTN9S

Exercises "\"





Deploy broken app via GitOps, get alerted and fix problem

GitOps process
 II









Promote a change in code all the way to production using GitOps

Monitoring (2)





Deploy a Grafana dashboard for an app using GitOps

Secrets Management





Integrate secrets into app, propagate updates automatically

Progressive Delivery



Watch a canary release live with argo roll

Getting started

- Login: admin / admin
- scmm.localhost
- argocd.localhost
- 👸 grafana.localhost 💡 skip changing password on first login
- wault.localhost
- mailhog.localhost
- jenkins.localhost



Exercise: GitOps+Alerting ?

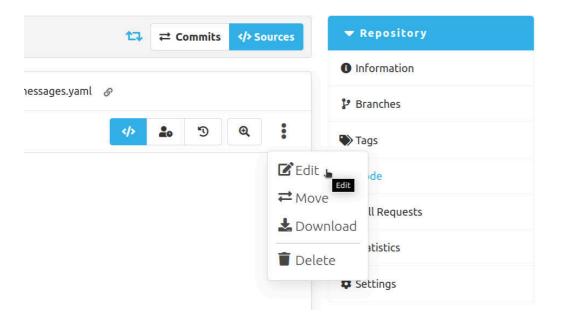




Deploy broken app via GitOps, get alerted and fix problem

Exercise: Alerting

- 1. Add repo to Argo CD
- 2. Create Argo CD Application YAML
- 3. Deploy, receive alert and fix app
 - Hint: Edit file in SCM-Manager



1. Add repo to Argo CD

Add this repo to Argo CD (via GitOps):

http://scmm-scm-manager.default.svc.cluster.local/scm/repo/exercises/broken-application

- 1. Add to repositories in Argo CD's config:
 - scmm.localhost/scm/repo/argocd/argocd/code/sources/main/argocd/values.yaml
- 2. Authorize Project to use the repo by adding it to sourceRepos here:
 - scmm.localhost/scm/repo/argocd/argocd/code/sources/main/projects/example-apps.yaml

2. Create Argo CD Application YAML

- Go to argocd.localhost, click + NEW APP
- Enter Name: broken
- Click on Project Name, choose example apps
- Click on Repository URL, choose the broken-application repo
- Enter Path: .
- Click on Cluster URL, choose https://kubernetes.default.svc
- Enter Namespace: example-apps-staging
- At the top, click EDITAS YAML and copy content

3. Deploy, receive alert and fix app

- Paste content here:
 - scmm.localhost/scm/repo/argocd/example-apps/code/sourceext/create/main/argocd/
- Enter Filename: broken.yaml, and commit message, then click



Go to argocd.localhost/applications/argocd/broken, click

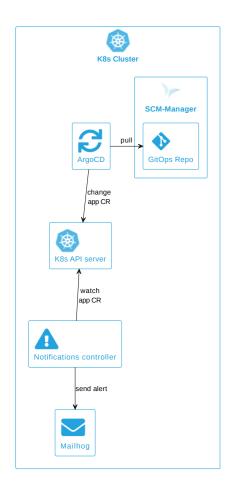


- Check email in mailhog.localhost
- Follow link to ArgoCD-UI, analyse error
- Fix error in repo:
 - scmm.localhost/scm/repo/argocd/example-
 - apps/code/sources/main/argocd/broken.yaml
- Go to paragocd.localhost/applications/argocd/broken, click paragocd/broken, click
- Follow ingress I link to open application in browser





Alerting in GOP





Argo CD config:

- github.com/cloudogu/gitops-playground/blob/0.2.0/argocd/argocd/argocd/values.ftl.yaml
- scmm.localhost/scm/repo/argocd/argocd/code/sources/main/argocd/values.yaml

See also

- GitOps repo structure in GOP
- ** Exercise: GitOps process



Exercise: GitOps process • Ci









Promote a change in code all the way to production using GitOps

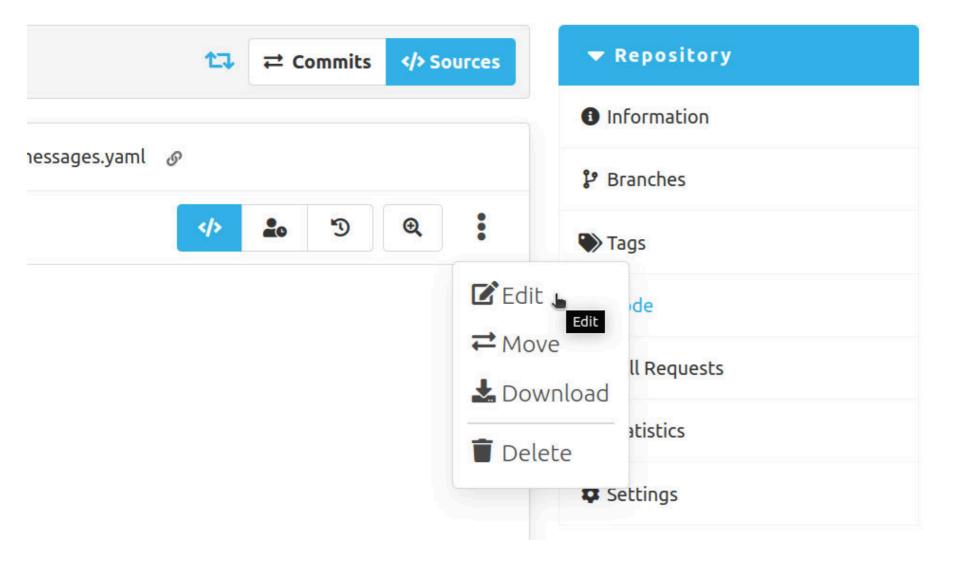
- Warmup
- GitOps with CI server and promotion



- 1. Open Argo CD Application:
 - argocd.localhost/applications/example-apps-staging/petclinic-plain
- 2. Open app in Browser:
 - staging.petclinic-plain.petclinic.localhost
- 3. Change welcome message in config repo:
 - scmm.localhost/scm/repo/argocd/example-apps/code/sources/main/apps/spring-petclinic-plain/staging/generatedResources/messages.yaml
- 4. Press CREFRESH in ArgoCD UI
- 5. Restart deploy in ArgoCD UI 🔁 Watch GitOps deployment
- 6. Reload app in Browser D Shows new message 🔯



Hint: Edit file in SCM-Manager



GitOps with CI server and promotion 🚀

First:

Accept pull request for petclinic-plain to deploy prod



Then:

- 1. Change app, build image, deploy staging
- 2. Accept pull request, deploy production

1. Change app, build image, deploy staging

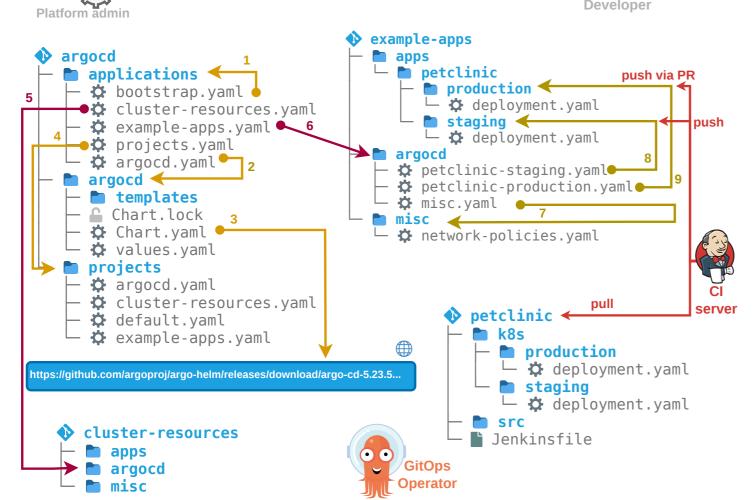
- 1. Open Argo CD Application for staging:
 - argocd.localhost/applications/example-apps-staging/petclinic-plain
- 2. Follow ingress I link to open application in browser
- 3. Change welcome message in app repo
 - scmm.localhost/scm/repo/argocd/petclinic-plain/code/sources/main/src/main/resources/messages/messages.properties
- 4. Wait for Build
 - jenkins.localhost/job/example-apps/job/petclinic-plain/job/main
- 5. Press CREFRESH in ArgoCD UI Watch GitOps deployment
- 6. Reload app in Browser D Shows message in staging 🗟

2. Accept pull request, deploy production

- 1. Open Argo CD Application for production:
 - argocd.localhost/applications/example-apps-production/petclinic-plain
- 2. Follow ingress I link to open application in browser
- 3. Accept pull request for petclinic-plain
 - scmm.localhost/scm/repo/argocd/example-apps/pull-requests
- 4. Press Green in ArgoCD UI Watch GitOps deployment
- 5. Reload app in Browser D Shows message in production 😂 😂



GitOps repo structure in GOP



- scmm.localhost/scm/repo/argocd/petclinic-plain/code/sources/main/Jenkinsfile uses
- github.com/cloudogu/gitops-build-lib

cloudogu.com/blog/gitops-repository-patterns-part-6-examples



- Deploy a Grafana dashboard for an app using GitOps
- (Expose and visualize metrics of Spring Boot app \(\bigg\))

Deploy a Grafana dashboard for an app using GitOps

- 1. Expose metrics
- 2. Create specific Grafana dashboard JSON
- 3. Deploy dashboard via GitOps
- 4. Watch metrics

1. Expose metrics

- Enable metrics export on nginx via GitOps
 - scmm.localhost/scm/repo/argocd/example-apps/code/sourceext/edit/main/apps/nginx-helm-umbrella/values.yaml

```
nginx:
  metrics:
    enabled: true
    serviceMonitor:
      enabled: true
```

• GO tO pargocd.localhost/applications/example-apps-production/nginx-helm-umbrella, click sync



Check if servicemonitor was created

2. Create specific Grafana dashboard JSON

- ografana.localhost/dashboard/import
- Paste content from here
 and click
 - github.com/nginxinc/nginx-prometheus-exporter/blob/v1.2.0/grafana/dashboard.json
- Name: nginx-helm-umbrella
- Click Select a Prometheus data source: Prometheus
- Click Import

3. Deploy dashboard via GitOps

- Copy JSON from grafana.localhost/d/MsjffzSZz?editview=dashboard_json
- to scmm.localhost/scm/repo/argocd/example-apps/code/sourceext/create/main/apps/nginx-helm-umbrella

```
apiVersion: v1
kind: ConfigMap
metadata:
   name: nginx-helm-umbrella-dashboard
   labels:
        grafana_dashboard: "1"
data:
   dashboard.json: |-
        # Paste your JSON, INDENTED BY 4 SPACES here
        {...
```

- Path: Add / templates
- Enter Filename: dashboard.yaml + commit message, click commit
- Go to paragocallocalhost/applications/example-apps-production/nginx-helm-umbrella, click
- Check if == configmap was created

4. Watch metrics

- Follow ingress I link to open app in browser
- Generate traffic by reloading
- Enjoy your dashboard
 - grafana.localhost/d/MsjffzSZz 🔯

Expose and visualize metrics of Spring Boot app T

- Expose container port by name:
 - scmm.localhost/scm/repo/argocd/petclinic-plain/code/sources/main/k8s/staging/deployment.yaml

```
ports:
    # ..
    containerPort: 9080
    name: actuator
```

- Expose prometheus metrics from app:
 - scmm.localhost/scm/repo/argocd/petclinic-plain/code/sources/main/pom.xml

```
<dependency>
  <groupId>io.micrometer</groupId>
   <artifactId>micrometer-registry-prometheus</artifactId>
</dependency>
```

Wait for build and deployment to staging

Create service for metrics port

```
apiVersion: v1
kind: Service
metadata:
  name: spring-petclinic-plain-monitor
  namespace: example-apps-staging
  labels:
    app: spring-petclinic-plain
    type: metrics
spec:
  ports:
    - name: metrics
      port: 9080
      protocol: TCP
      targetPort: actuator
  selector:
    app: spring-petclinic-plain
```

Use kubectl for faster iteration. GitOps can come later.

Create service monitor

```
apiVersion: monitoring.coreos.com/v1
kind: ServiceMonitor
metadata:
  name: spring-petclinic-plain-monitor
  namespace: example-apps-staging
spec:
  endpoints:
    - interval: 15s
      path: /actuator/prometheus
      port: actuator
  namespaceSelector:
    matchNames:
      - example-apps-staging
  selector:
    matchLabels:
      app: spring-petclinic-plain
      type: metrics
```

Find a suitable JVM / spring / micrometer dashboard and import it to Grafana





Exercise: Secrets Management





Integrate secrets into app, propagate updates automatically

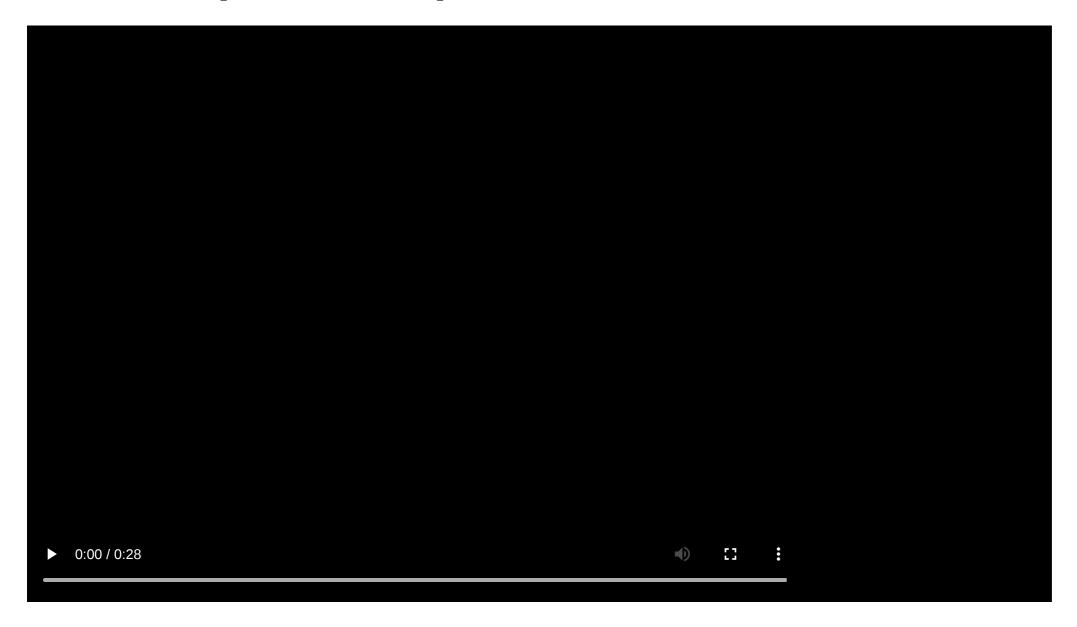
- Warmup
- Mount secret into app

Warmup 💖

- Secret exposed via HTTP
 - staging.nginx-helm.nginx.localhost/secret
- Change in Vault:
 - vault.localhost/ui/vault/secrets/secret/edit/staging/nginx-helm-jenkins
- Watch it propagate automatically (<2 min)
 Either reload Browser or:

```
while ; do echo -n "$(date '+%Y-%m-%d %H:%M:%S'): " ; \
    curl staging.nginx-helm.nginx.localhost/secret/ ; echo; sleep 1; done
```

Warmup in time-lapse



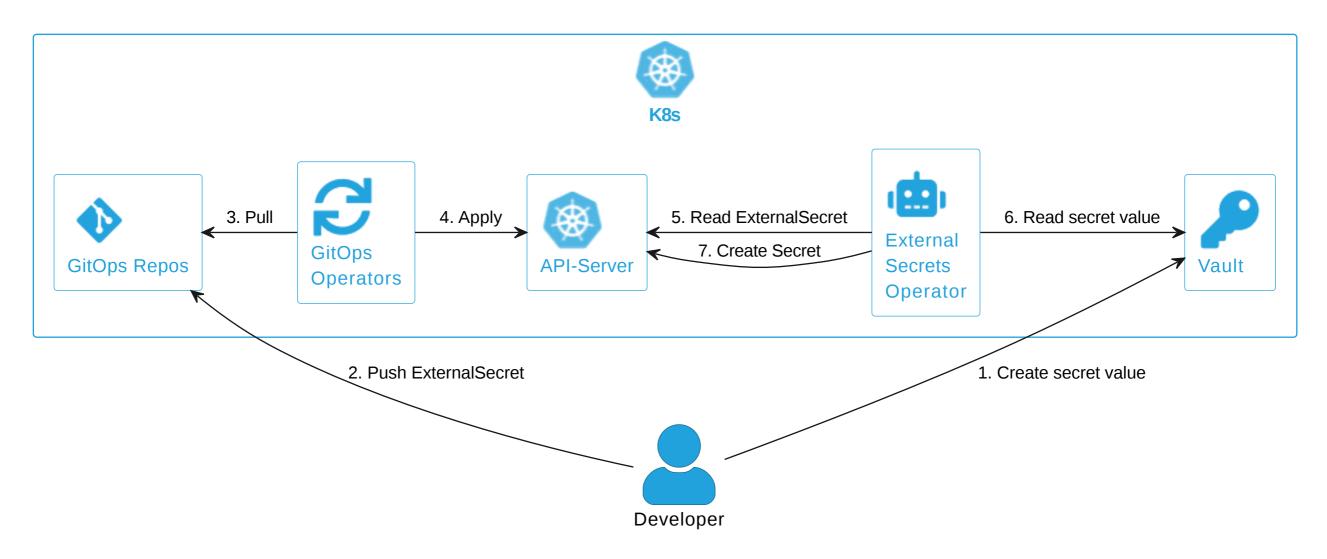
Mount secret into app 🚀

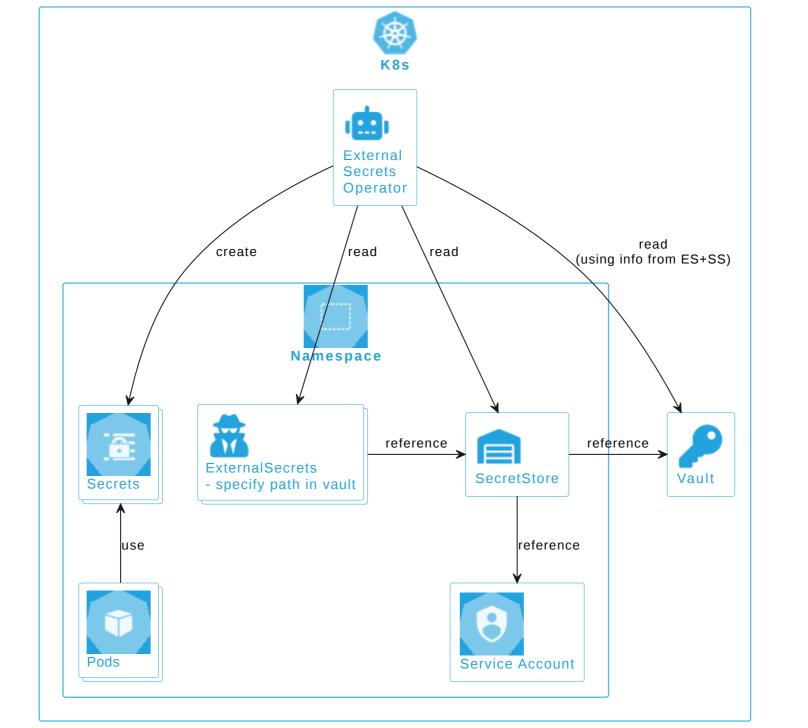
Create a new secret in Vault and mount it into an app

- 1. Create secret in Vault and sync into cluster via ExternalSecret
- 2. Use secret in app

Let's start with some basics

External Secrets Operator (ESO) with Vault





ESO+Vault config in GOP

- SecretStore per Namespace:
 - scmm.localhost/scm/repo/argocd/cluster-resources/code/sources/main/misc/secrets/secret-store-staging.yaml
- Example ExternalSecret:
 - scmm.localhost/scm/repo/argocd/nginx-helm-jenkins/code/sources/main/k8s/staging/external-secret.yaml
- Mounted into app:
 - scmm.localhost/scm/repo/argocd/nginx-helm-jenkins/code/sources/main/k8s/values-shared.yaml

1. Create secret in Vault and sync into cluster via ExternalSecret

- 1. Create secret in Vault
- wault.localhost/ui/vault/secrets/secret
- Click Create secret +
- Path for this secret: production/nginx-helm-umbrella
- key: my-secret, value: choose any
- 2. Deploy ExternalSecret via GitOps (* example on previous slide)
 - scmm.localhost/scm/repo/argocd/example-apps/code/sourceext/create/main/apps/nginx-helm-umbrella
- Path: Add / templates
- Enter Filename: secret.yaml + commit message, click commit
- 3. Go to pargocd.localhost/applications/example-apps-production/nginx-helm-umbrella, click sync
- 4. Check if secret was created

2. Use secret in app

- 4. Mount secret into NGINX (* example on previous slide):
 - scmm.localhost/scm/repo/argocd/example-apps/code/sourceext/edit/main/apps/nginx-helm-umbrella/values.yaml
 - Hint: Add one nginx.extraVolumes and one nginx.extraVolumeMounts
- 5. Go to argocd.localhost/applications/argocd/broken, click sync
- 6. Follow ingress I link to open application in browser
- 7. Add path / secret
- 8. Optional: Change the secret in Vault and wait for sync as in Warmup 🤓



Please take a few moments to answer 5 short questions about GOP



Thanks for helping us improve ...





Yannick Christian Thomas Johannes Schnatterer Cloudogu GmbH

Please reach out for all questions or feedback!

- yannick.thomas@cloudogu.com iohannes.schnatterer@cloudogu.com

- in/yannickchristhomas in in/jschnatterer @@schnatterer@floss.social



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