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

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Slides

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Version: 202406191530-4e286bb

Agenda

1. Intro
2. Meet GOP
3. Exercises, Getting Started

cloudogu

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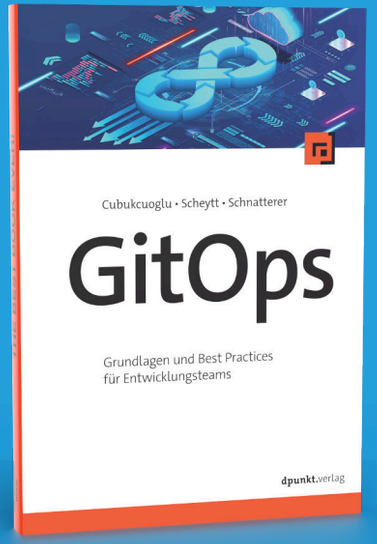

🙋 What is your profession?

🤓 Software Engineer / Developer

🙋 What is your profession?

🛠️ Platform Engineer / Ops person

 What is your profession?

 None of the above

🙋 Who uses Kubernetes for local development?

k3d Minkube Microk8s k3s KIND

Docker Desktop k0s Rancher Desktop

Kelsey Hightower
@kelseyhightower

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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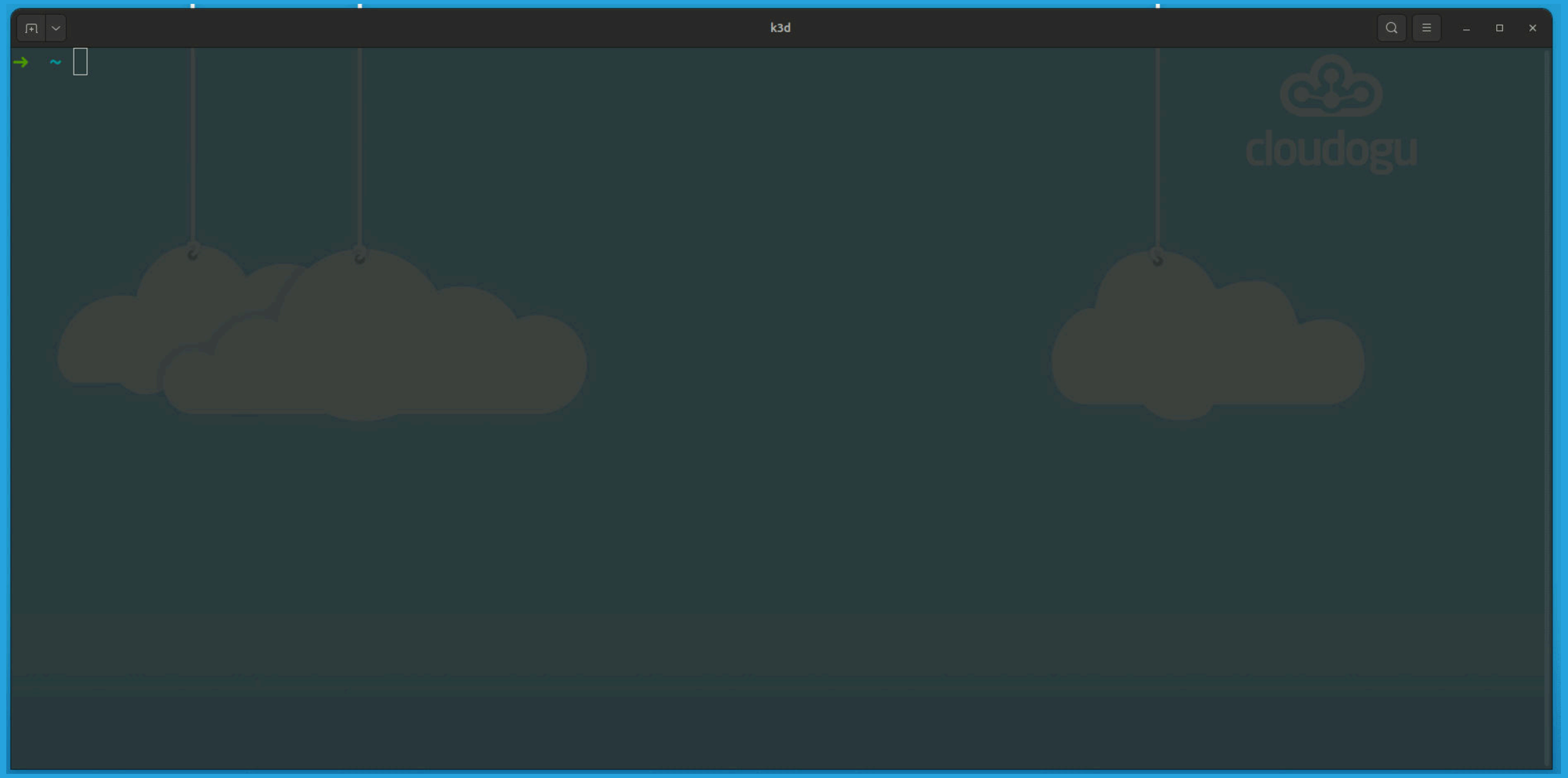
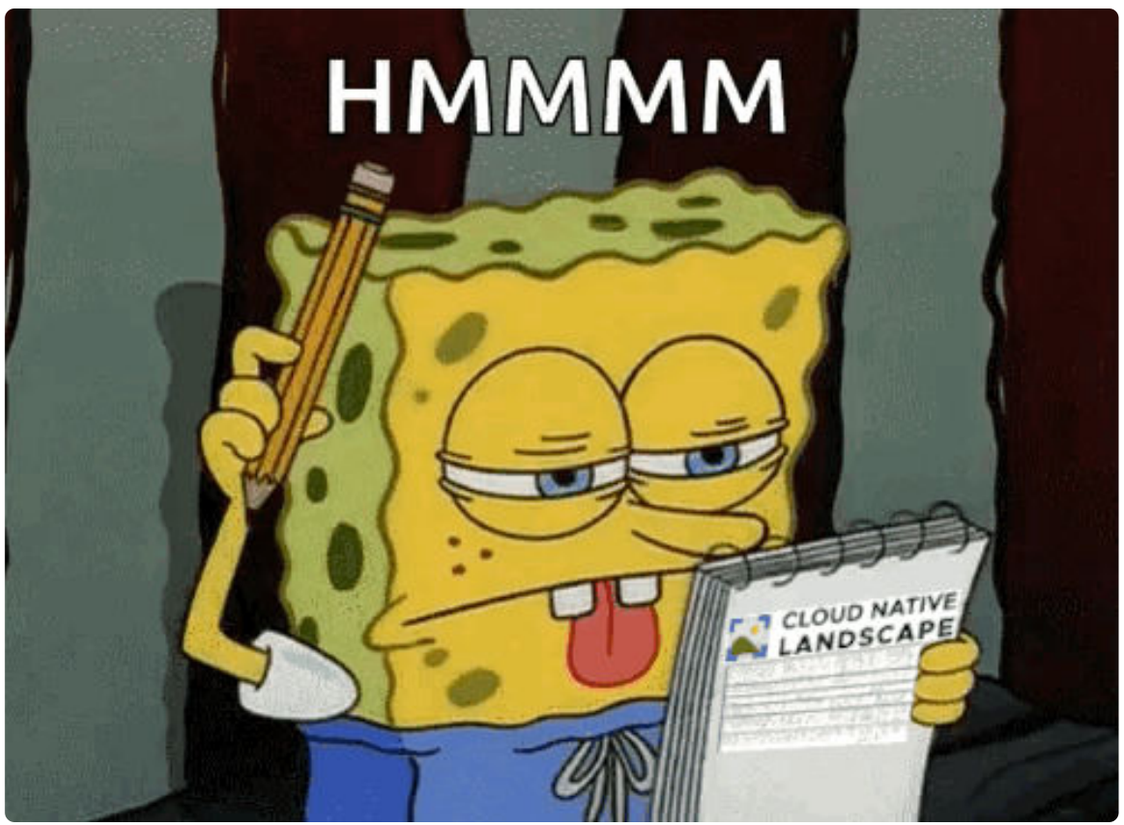
237 Reposts **44** Quotes **748** Likes **22** Bookmarks

twitter.com/kelseyhightower/status/935252923721793536

Start a local k8s cluster with one command



Next, start the platform



tenor.com/view/spongebob-squarepants-spongebob-think-thinking-gif-4280214517394111861

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

a98089f [redacted] / scripts / apply.sh ↑ Top

Code Blame Raw

```
669         --metrics | --monitoring ) shift;; # Ignore, used in groovy only
670         --mailhog-url            ) shift 2;; # Ignore, used in groovy only
671         --vault                  ) shift 2;; # Ignore, used in groovy only
672         --petclinic-base-domain ) shift 2;; # Ignore, used in groovy
673         --nginx-base-domain      ) shift 2;; # Ignore, used in groovy on
674         --destroy                ) DESTROY=true; shift;;
675         --config-file            ) shift;; # Ignore, used in groovy only
676         --config-map             ) shift;; # Ignore, used in groovy only
677         --output-config-file ) OUTPUT_CONFIG_FILE=true; shift;;
678         --                       ) shift; break ;;
679       *) break ;;
680       esac
681     done
682   }
683
684   main "$@"
```

Why not start the platform with one command?

Meet GOP

a GitOps-based operational stack (platform)

Slides

```
VERSION='0.3.0'
bash <(curl -s \
  "https://raw.githubusercontent.com/cloudogu/gitops-playground/$VERSION/scripts/init-cluster.sh") \
   && docker run --rm -t -u $(id -u) \
    -v ~/.config/k3d/kubeconfig-gitops-playground.yaml:/home/.kube/config \
    --net=host \
    ghcr.io/cloudogu/gitops-playground:$VERSION --yes --base-url=http://localhost --ingress-nginx \
      --argocd --monitoring --vault=dev --mailhog
```

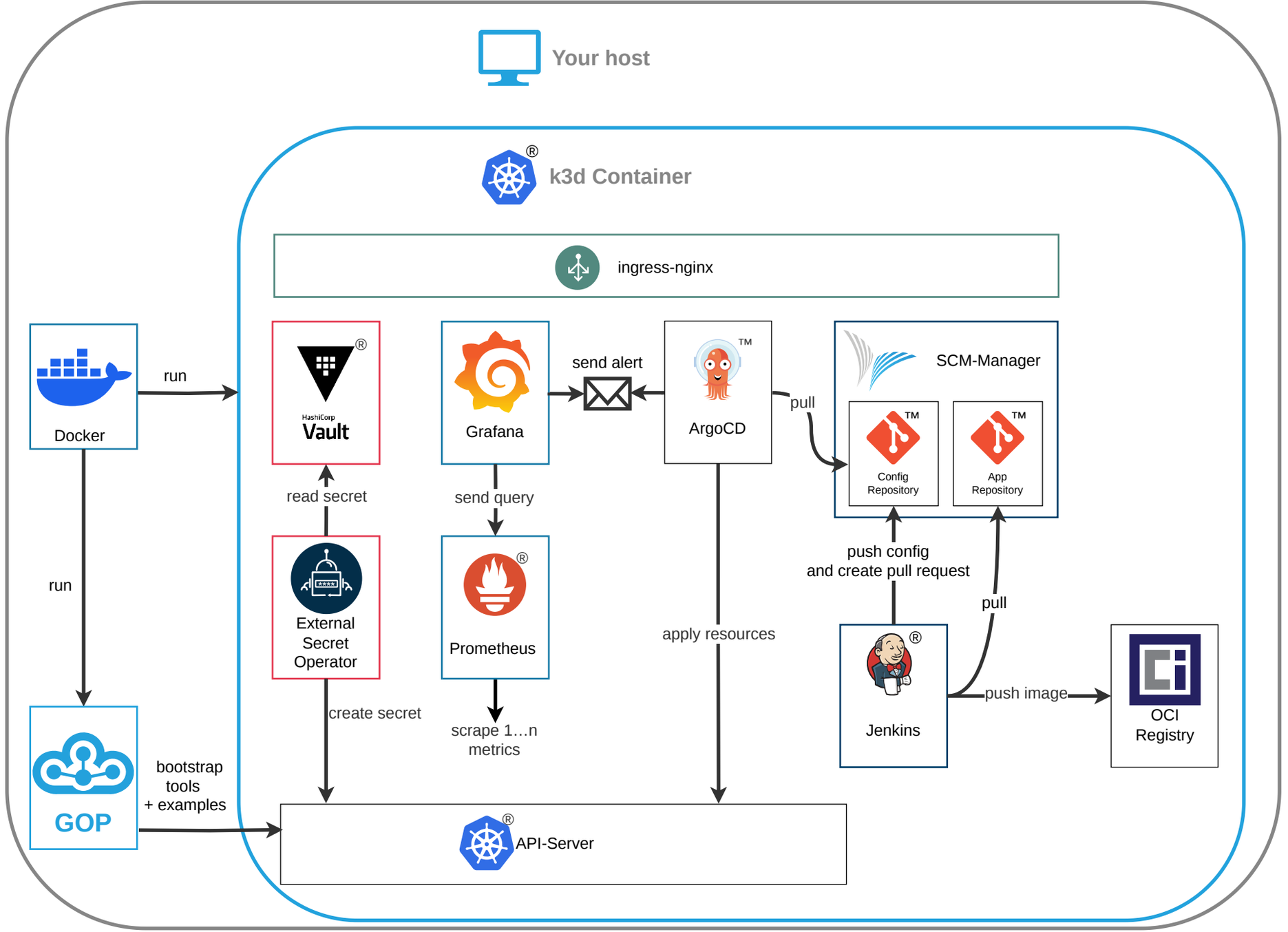
cloudogu/gitops-playground

💡 k3d hints

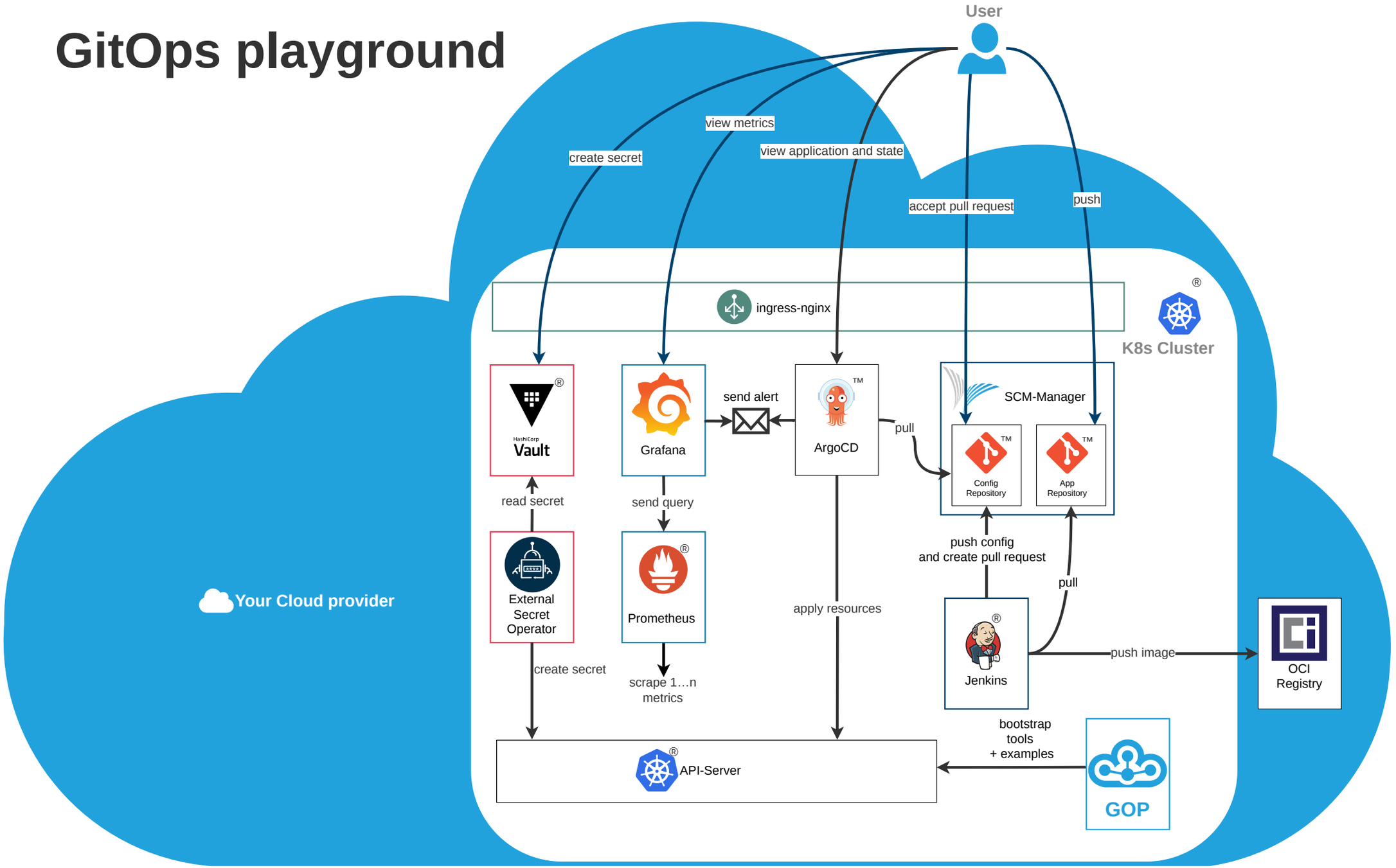
```
# Get an overview
kubectl get ingress -A # --context k3d-gitops-playground
# Also possible without installing kubectl
docker exec  k3d-gitops-playground-server-0 kubectl get ingress -A
```

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

```
# Cleanup
k3d cluster rm gitops-playground
# Or
docker rm $(docker ps -a -q --filter "name=^k3d-gitops-playground")
```



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
```

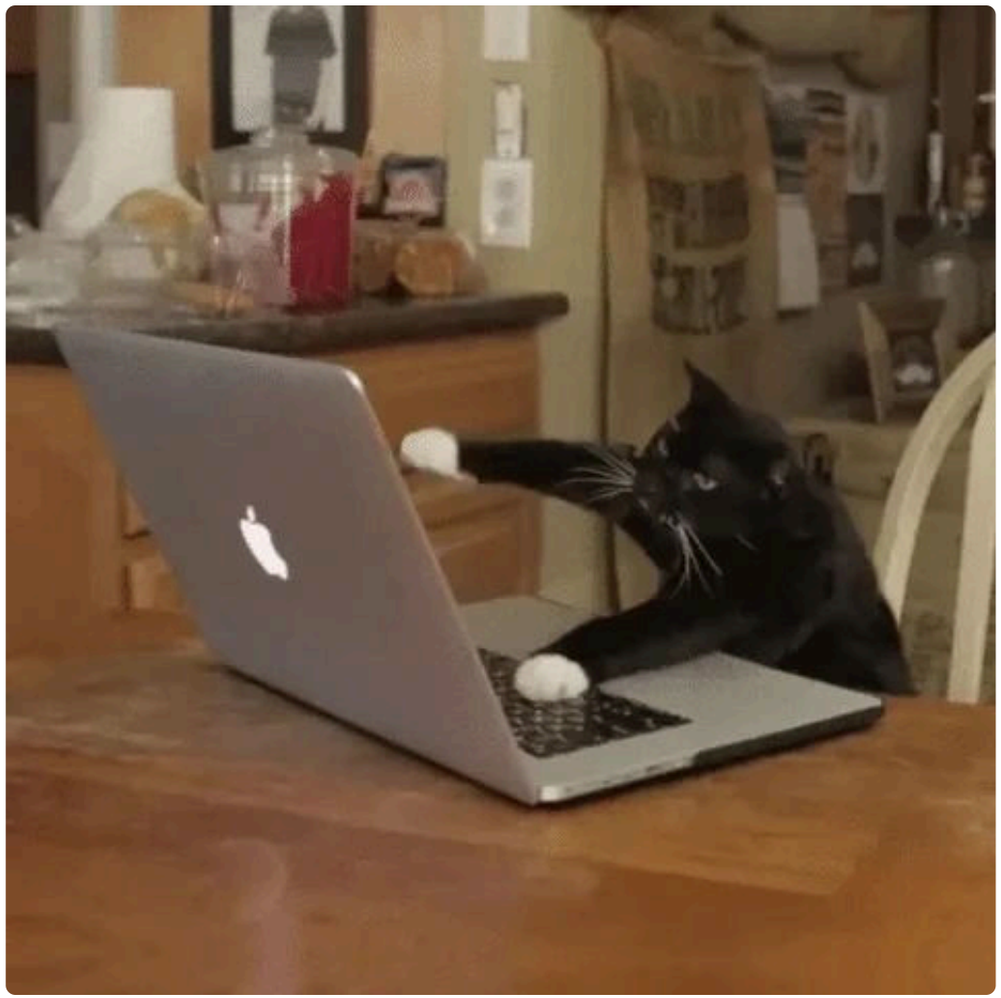
docker run ...

```
docker run
  # Remove container after running, keeping your device clean
  # (remove in case of error to preserve logs)
  --rm
  # Colorful output, please
  -t
  # Mount kubeconfig for k3d
  -v ~/.config/k3d/kubeconfig-gitops-playground.yaml:/home/.kube/config \
  # Run as current user to avoid  permission issues with kubeconfig
  -u $(id -u) \
  # Make k3d cluster available on 0.0.0.0 as described in kubeconfig
  --net=host \
# Image, pin for reproducibility
ghcr.io/cloudogu/gitops-playground:$VERSION \
  #Params for gop:
  --yes --base-url=http://localhost --ingress-nginx --argocd --monitoring --vault=dev --mailhog
```

`ghcr.io/cloudogu/gitops-playground`

- OCI image
- Contains logic to install and configure the tools
- App written in Groovy (and bash 😰)
- Additional resources to run e.g. in air-gapped envs

Your turn



giphy.com/gifs/JJX9t2j0ZTN9S

Exercises

- **GitOps+Alerting**

  Deploy broken app via GitOps, get alerted and fix problem
- **GitOps process**

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

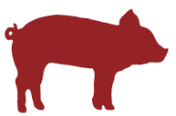
  Deploy a Grafana dashboard for an app using GitOps
- **Secrets Management**

  Integrate secrets into app, propagate updates automatically
- ~~Progressive Delivery~~ Reach out if interested

  ~~Watch a canary release live with argo rollouts~~

 Getting started

- Login: `admin` / `admin`
-  scmm.localhost
-  argocd.localhost
-  grafana.localhost  skip changing password on first login
-  vault.localhost
-  mailhog.localhost
-  jenkins.localhost

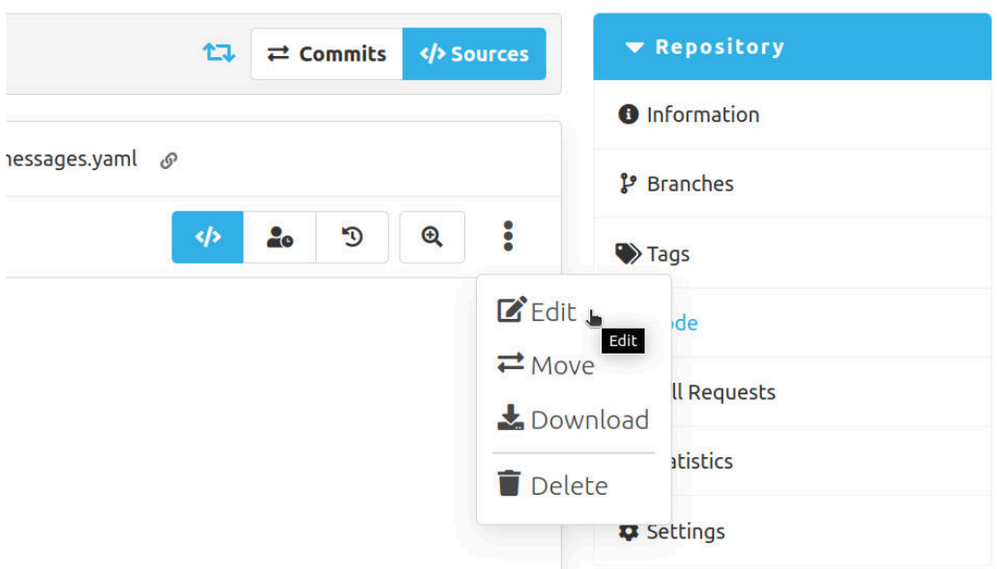
🏋️ Exercise: GitOps+Alerting  

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

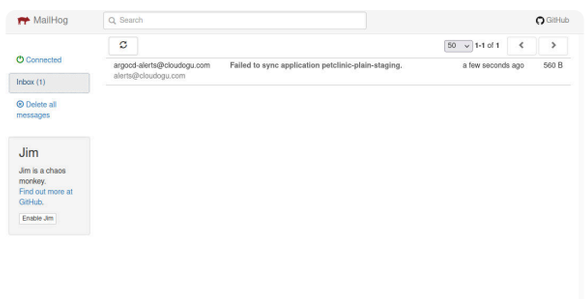
- Go to  argocd.localhost, click + NEW APP
- Enter `Name`: `broken`
- Click on `Project Name`, choose `example apps`
- Click on `Repository URL`, choose the `broken-application` repo
- Enter `Path`: `.`
- Click on `Cluster URL`, choose `https://kubernetes.default.svc`
- Enter `Namespace`: `example-apps-staging`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

3. Deploy, receive alert and fix app

- Paste content here:

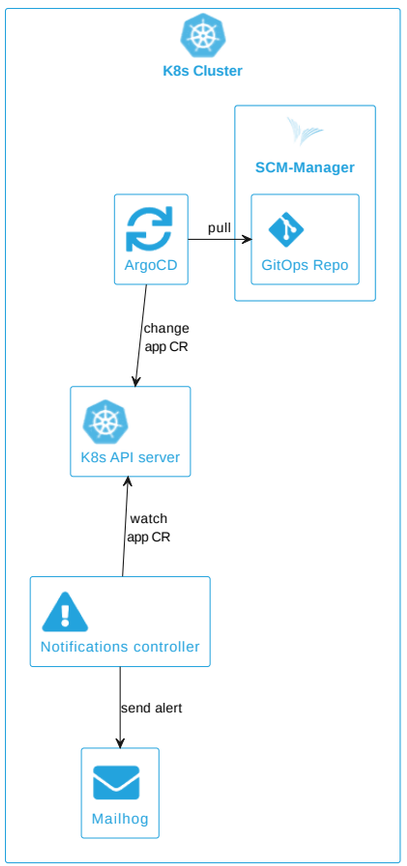
  scmm.localhost/scm/repo/argocd/example-apps/code/sourceext/create/main/argocd
- Enter `Filename`: `broken.yaml`, and commit message, then click Commit
- Go to argocd.localhost/applications/argocd/broken, click SYNC
- Check email in mailhog.localhost
- Follow link to ArgoCD-UI, analyse error
- Fix error in repo:

  scmm.localhost/scm/repo/argocd/example-apps/code/sources/main/argocd/broken.yaml
- Go to argocd.localhost/applications/argocd/broken, click SYNC
- Follow `ingress` link to open application in browser



Then have a closer look at the concepts behind this 👇

Alerting in GOP



Argo CD config:

github.com/cloudogu/gitops-playground/blob/0.3.0/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  

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

- Warmup 🤓
- GitOps with CI server and promotion 🚀

Warmup 🤓

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

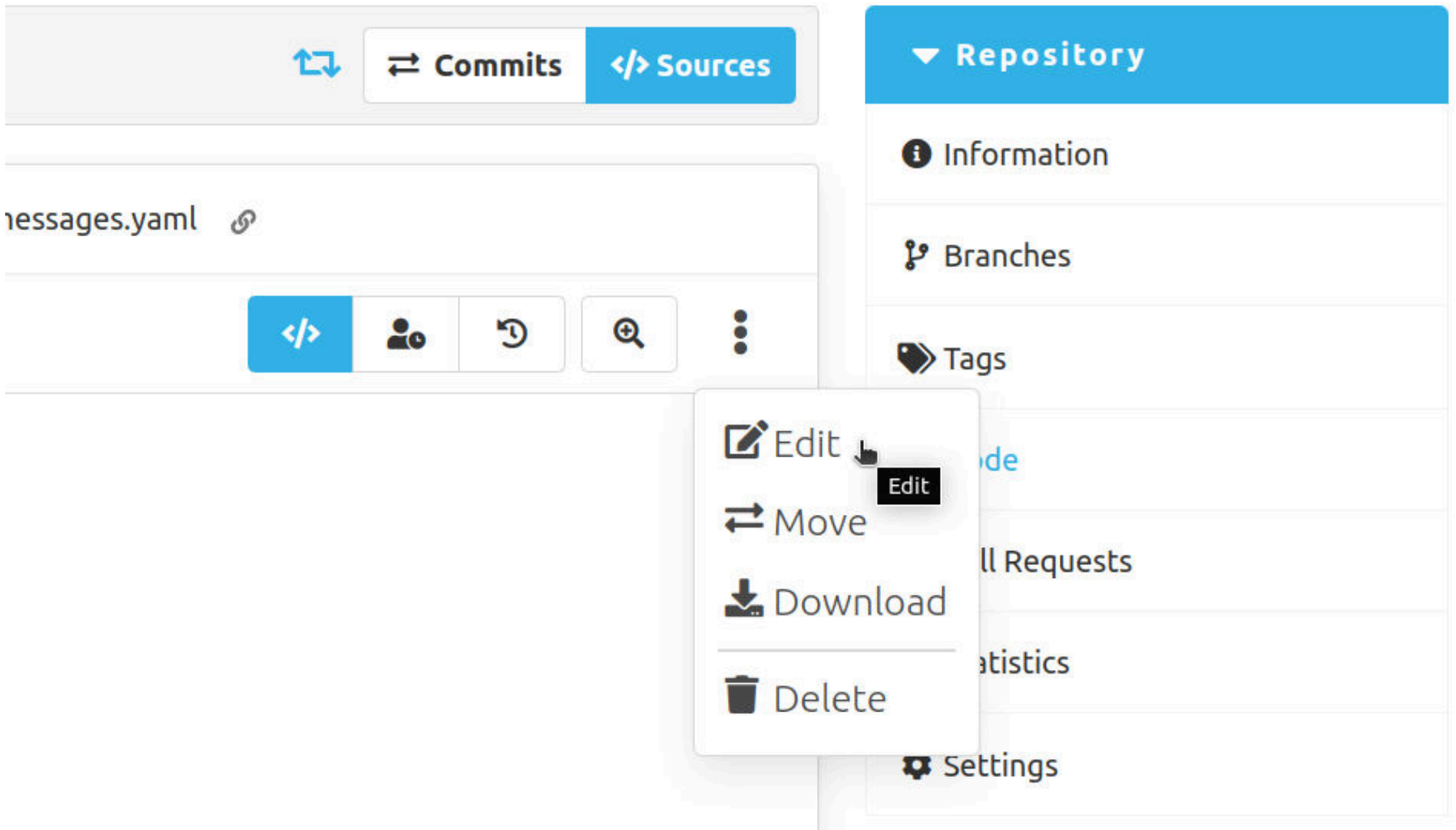
4. Press 

in ArgoCD UI

5. `Restart deploy` in ArgoCD UI ➡️ Watch GitOps deployment

6. 🔄 Reload app in Browser ➡️ 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

 scmm.localhost/scm/repo/argocd/example-apps/pull-requests

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` 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 REFRESH in ArgoCD UI ➡ Watch GitOps deployment
6. 🔄 Reload app in Browser ➡ Shows message in staging 🥳

2. Accept pull request, deploy production

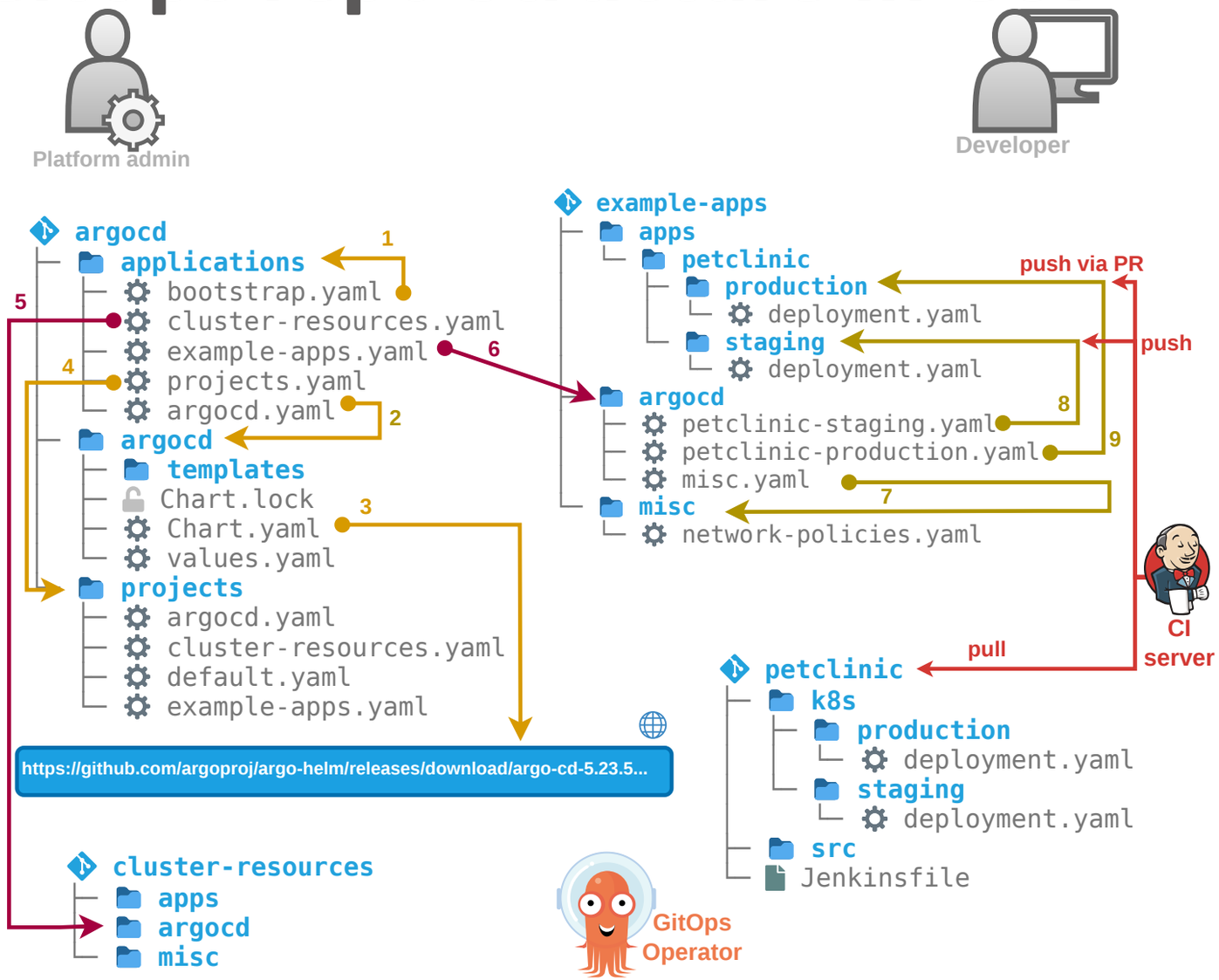
1. Open Argo CD `Application` for production:

    argocd.localhost/applications/example-apps-production/petclinic-plain
2. Follow  `ingress`  link to open application in browser
3. Accept pull request for `petclinic-plain`

    scmm.localhost/scm/repo/argocd/example-apps/pull-requests
4. Press  in ArgoCD UI  Watch GitOps deployment
5.  Reload app in Browser  Shows message in production 

Have a closer look at the concepts behind this 

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

🏋️ Exercise: Monitoring  

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

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 argocd.localhost/applications/example-apps-production/nginx-helm-umbrella, click SYNC
- Check if `servicemonitor` was created

2. Create specific Grafana dashboard JSON

- grafana.localhost/dashboard/import
- Paste content from here 👇 and click Load

  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
  - `Path`: **Add** `/files`
  - Enter `Filename`: `dashboard.json` + commit message, click **Commit**
- Add another file

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: nginx-helm-umbrella-dashboard
  labels:
    grafana_dashboard: "1"
data:
  dashboard.json: |-
{{ .Files.Get "files/dashboard.json" | indent 4 }}
```

- `Path`: **Add** `/templates`
- Enter `Filename`: `dashboard.yaml` + commit message, click **Commit**
- Go to argocd.localhost/applications/example-apps-production/nginx-helm-umbrella, click SYNC
- Check if `configmap` was created

4. Watch metrics

- Follow 🔀 `ingress` 🔗 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 🏆

- 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

```yaml
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

```yaml
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

 grafana.com/grafana/dashboards 🥳

🏋️ Exercise: Secrets Management 

Integrate secrets into app, propagate updates automatically

- Warmup 🤓
- Mount secret into app 🚀

Warmup 🤓

- Secret exposed via HTTP 😅

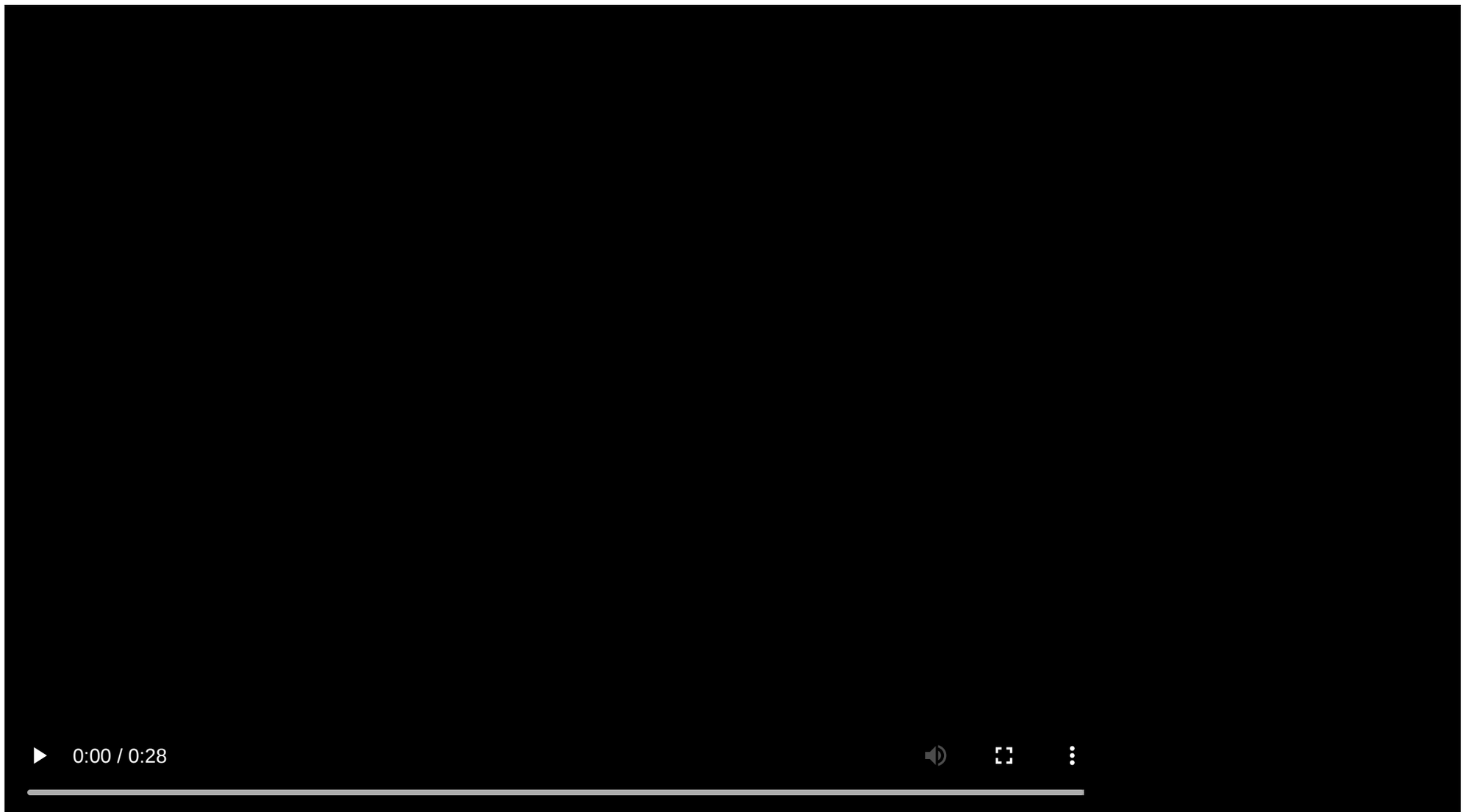
  🌐 staging.nginx-helm.nginx.localhost/secret
- Change in Vault:

  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



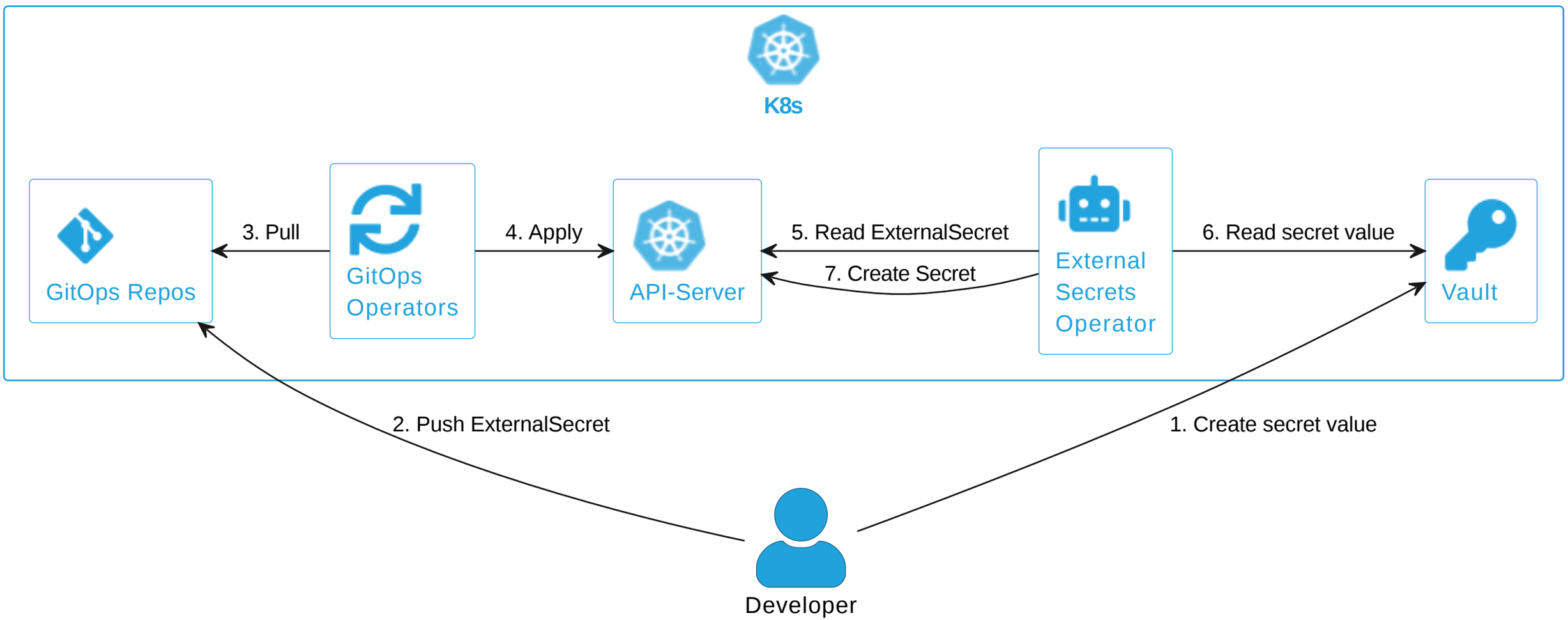
Mount secret into app 🚀

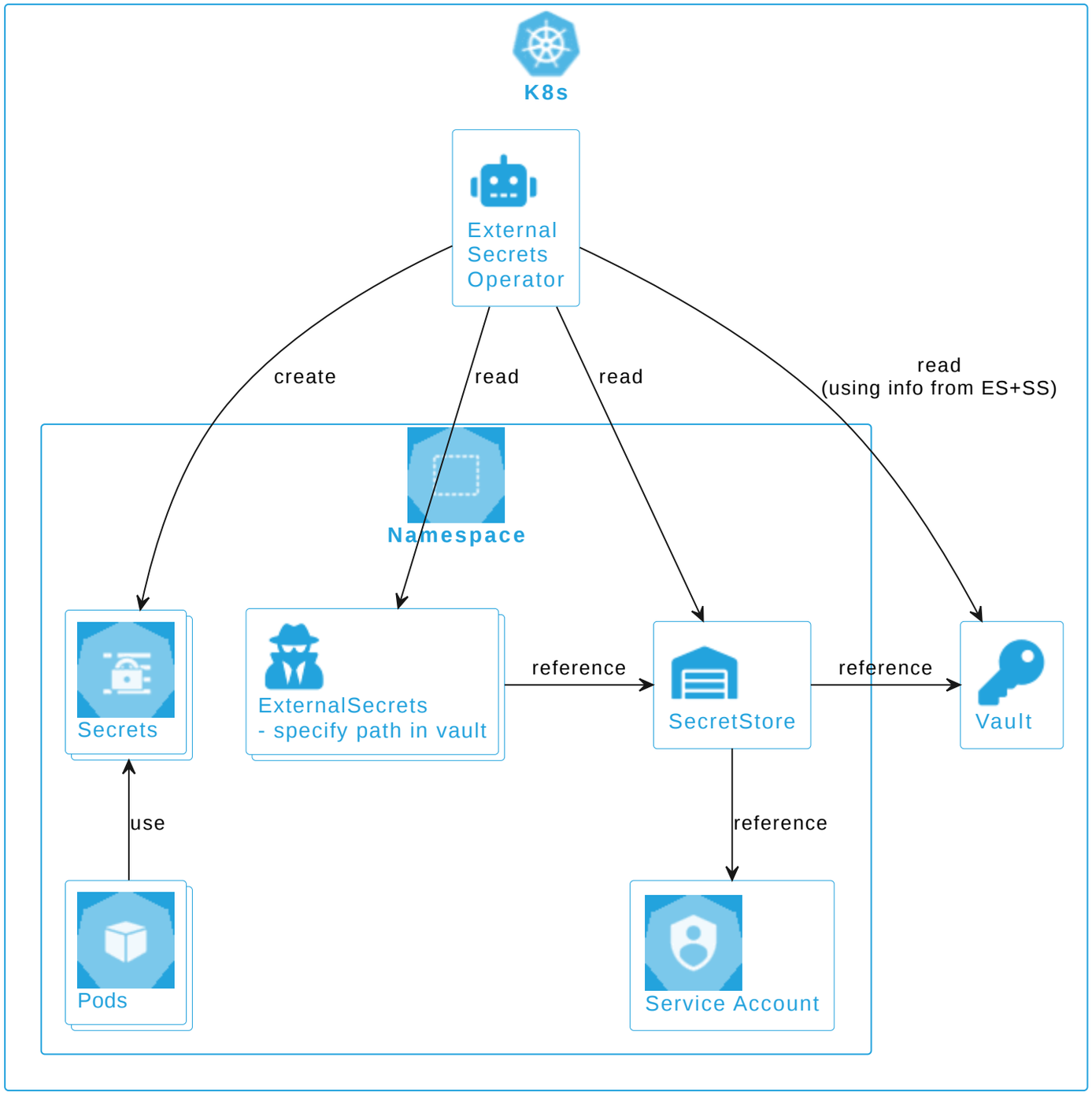
Create a new secret in Vault and mount it into an app

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




K8s
External Secrets Operator
create
read
read
read
(using info from ES+SS)
Namespace
Secrets
ExternalSecrets
- specify path in vault
reference
SecretStore
reference
Vault
use
reference
Pods
Service Account

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
   - vault.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 argocd.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` link to open application in browser
7. Add path `/secret` 🥳
8. Optional: Change the secret in Vault and wait for sync as in Warmup 🤓

⚠️ Secret in vault is transient, i.e. gone after restart (dev mode)

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

Thanks for helping us improve 🙏

Yannick Christian Thomas
Johannes Schnatterer
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Please reach out for all questions or feedback!

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