// CONTINUOUS OPERATIONS WITH GITOPS - AN INTRODUCTION

Johannes Schnatterer, Cloudogu GmbH

@jschnatterer

Version: 202109151213-b9d957a

Agenda

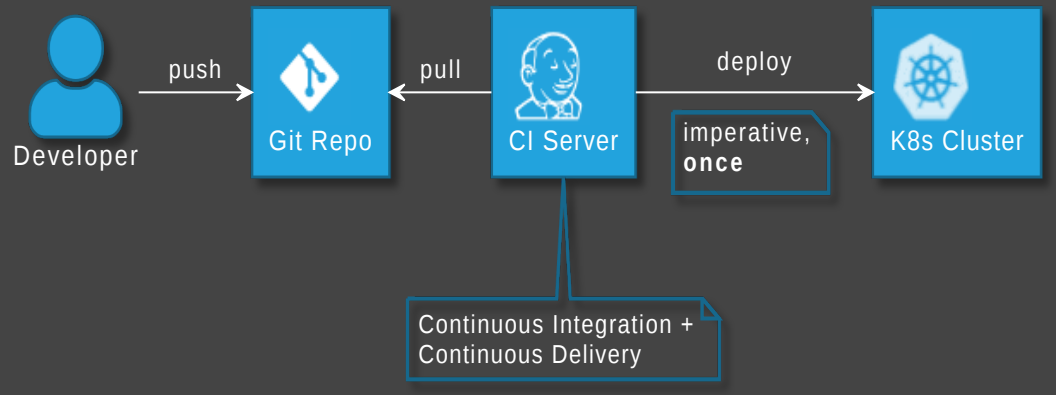
- What is GitOps?
- How can it be used?
- What challenges arise?

What is GitOps?

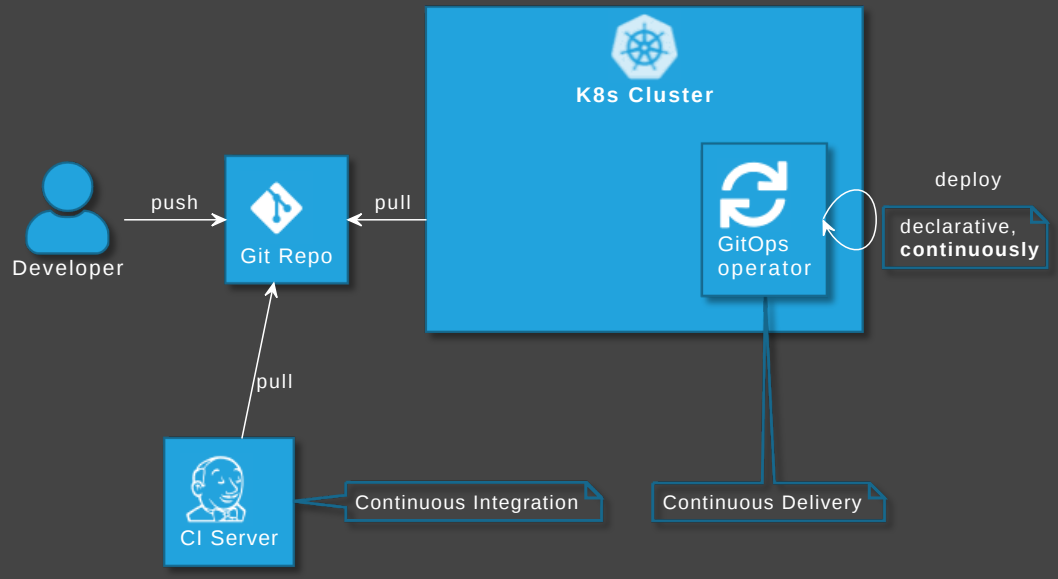
- Operating model
- Origin: blog post by Weaveworks, August 2017

> Use developer tooling to drive operations
> 🌐 weave.works/blog/gitops-operations-by-pull-request

"Classic" Continuous Delivery ("CIOps")



GitOps



GitOps Principles

1. The principle of declarative desired state
2. The principle of immutable desired state versions
3. The principle of continuous state reconciliation
4. The principle of operations through declaration

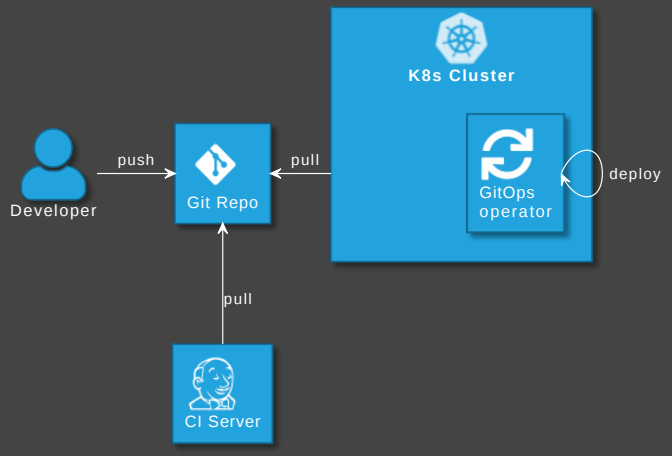
github.com/open-gitops/documents/blob/main/PRINCIPLES.md

GitOps vs DevOps

- DevOps is about collaboration of formerly separate groups (mindset)
- GitOps focuses on ops (operating model)
- GitOps can be used with or without DevOps

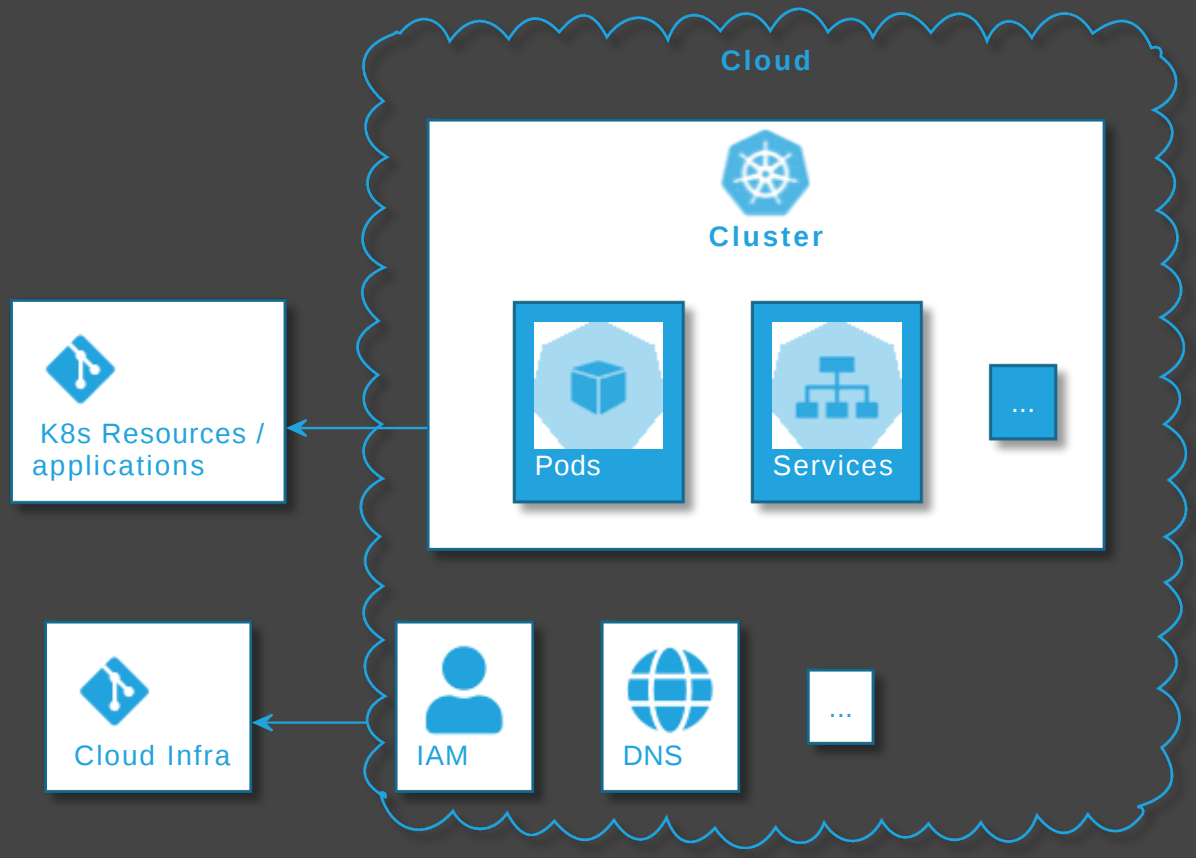
Advantages of GitOps

- No access to cluster from outside
  - ➡ No credentials on CI server
- Forces declarative description
- IaC is auditable
- Scalability - one repo many applications
- Self-healing / Hands-off ops



How can GitOps be used?

What can GitOps be used for?



GitOps tool categories

- GitOps operators/controllers
- Supplementary GitOps tools
- Tools for operating k8s clusters + cloud infra with GitOps

GitOps operators/controllers

Supplementary GitOps tools

Secrets

- bitnami-labs/sealed-secrets
- Soluto/kamus
- mozilla/sops + K8s integration
- Operators for Key Management Systems

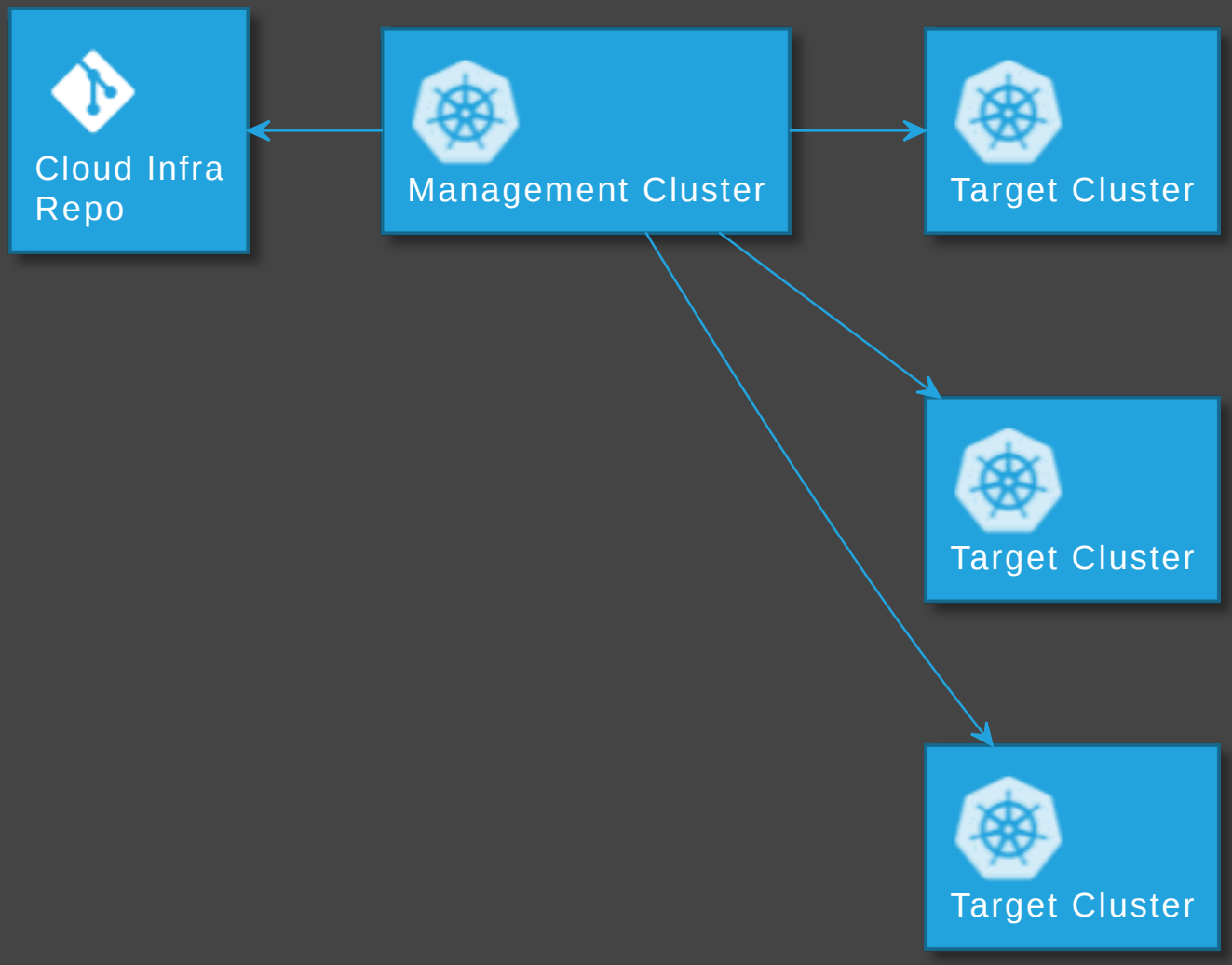
Others

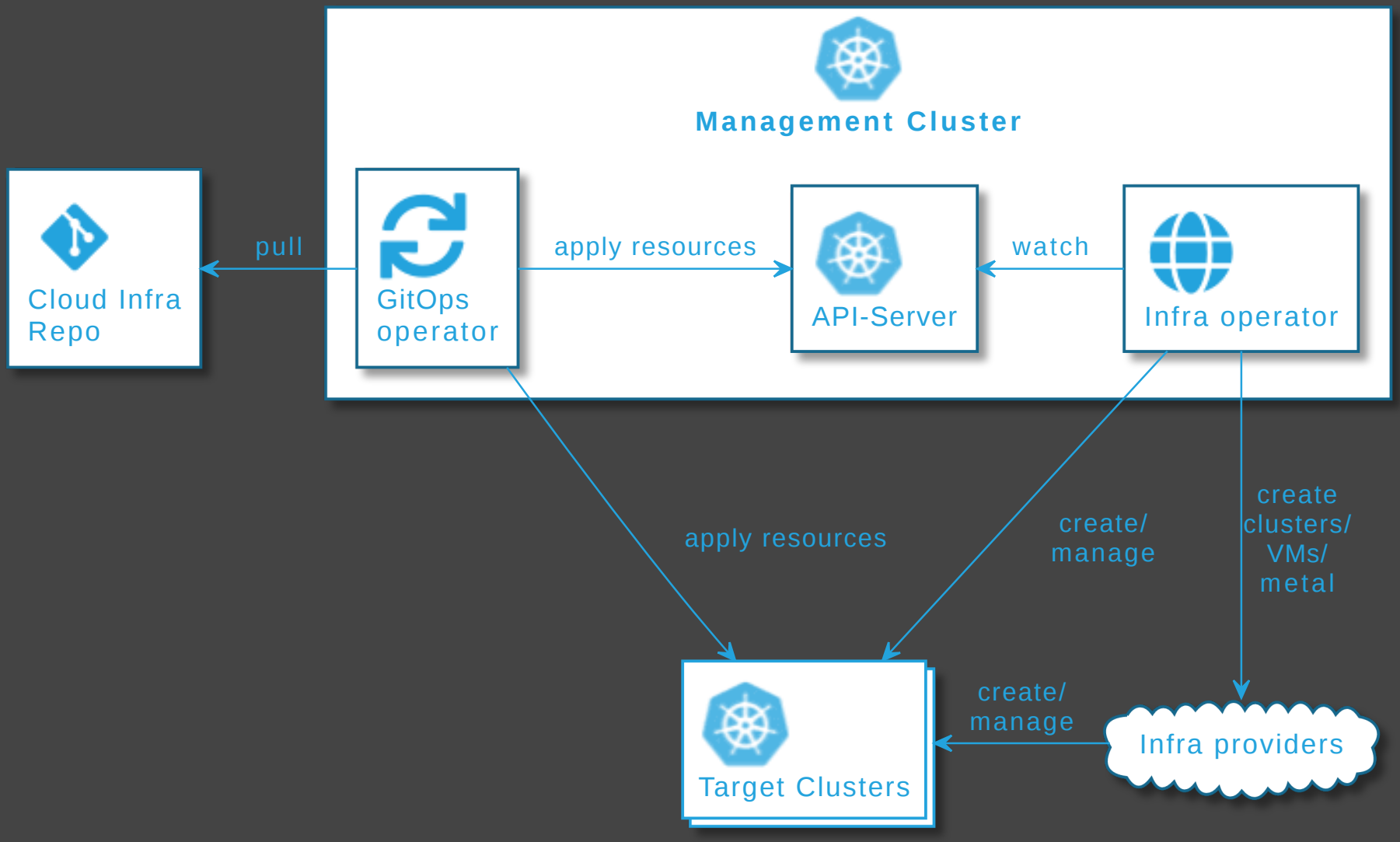
- Backup
- Deployment Strategies - Progressive Delivery

- ...

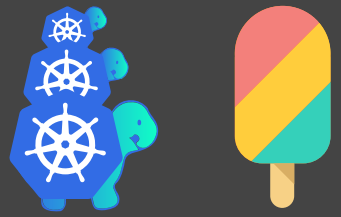
➡ **GitOps loves operators**

Operate Kubernetes with Kubernetes




Management Cluster
Cloud Infra Repo
pull
GitOps operator
apply resources
API-Server
watch
Infra operator
apply resources
create/ manage
create clusters/ VMs/ metal
Target Clusters
create/ manage
Infra providers

Tools for operating k8s clusters + cloud infra



+

-

Cloud or Operator

-
- rancher/terraform-controller
-

See also

☁ cloudogu.com/blog/gitops-tools (iX 4/2021)

- General tool comparison,
- tips on criteria for tool selection,
- comparison of ArgoCD v1 and Flux v2

What challenges arise with GitOps?

More Infra ...

- GitOps Operator: One or more custom controllers
- Helm, Kustomize Controllers
- Operators for Supplementary tools (secrets, etc.)
- Monitoring/Alerting systems
- ...

… higher cost

- Maintenance/patching (vendor lock-in)
- Resource consumption
- Learning curve
- Error handling
  - failing late and silently
  - monitoring/alerting required
  - reason might be difficult to pinpoint
  - operators cause alerts (OOM errors, on Git/API server down, etc.)

Day two questions

- POC is simple
- Operations in prod has its challenges
  - How to realize staging?
  - How to structure repos and how many of them?
  - Role of CI server?
  - How to realize local dev env?
  - How to delete resources?
  - ...

Implementing stages

Idea 1: Staging Branches

- Develop ➡️ Staging
- Main ➡️ Production

Logic for branching complicated and error prone (merges)

Idea 2: Staging folders

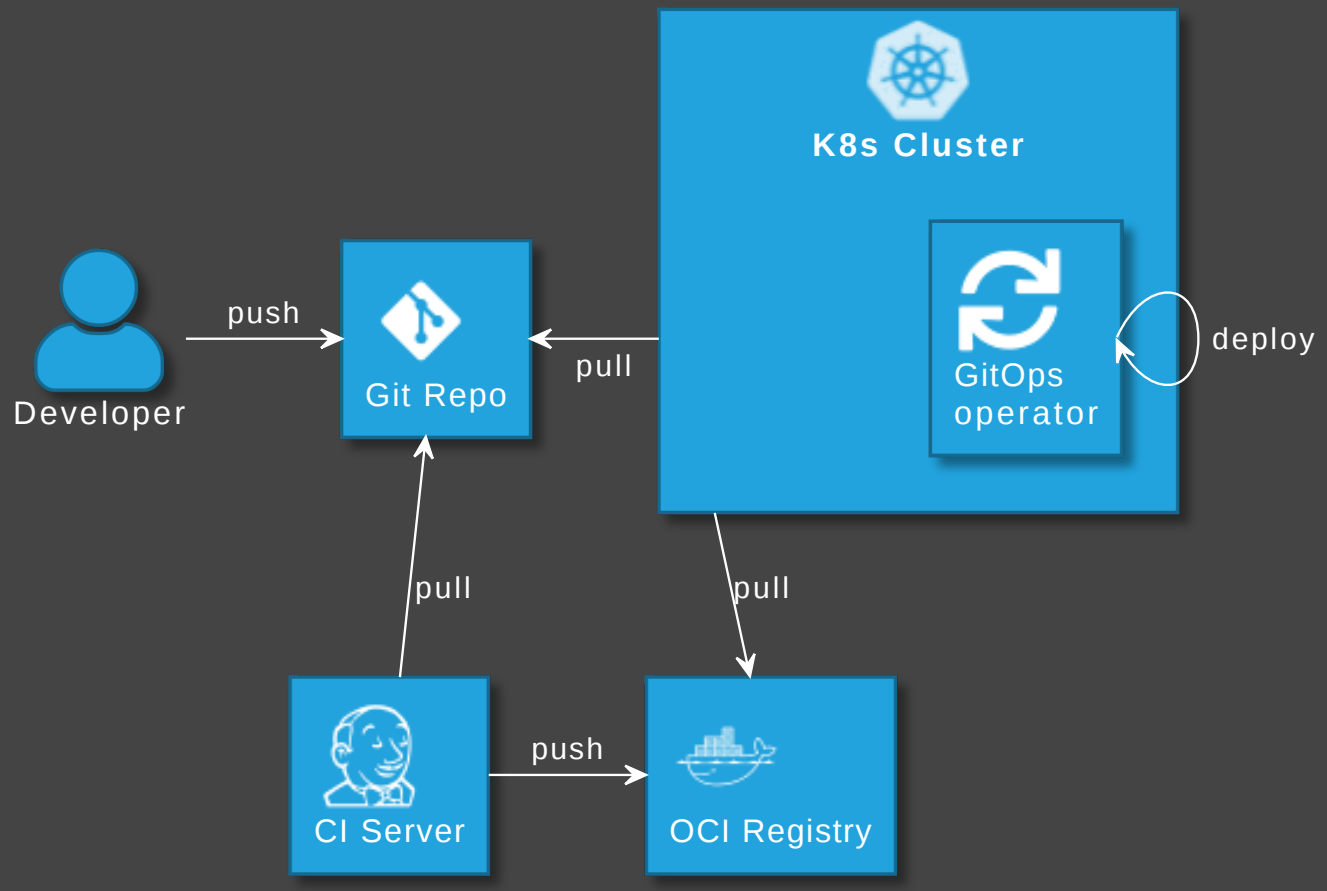
- On the same branch: One folder per stage

```
├── production
│   └── application
│       └── deployment.yaml
└── staging
    └── application
        └── deployment.yaml
```

- Process:
  - commit to staging folder only,
  - create short lived branches and pull requests for prod
- Duplication is tedious, but can be automized

- Logic for branching simpler
- Supports arbitrary number of stages

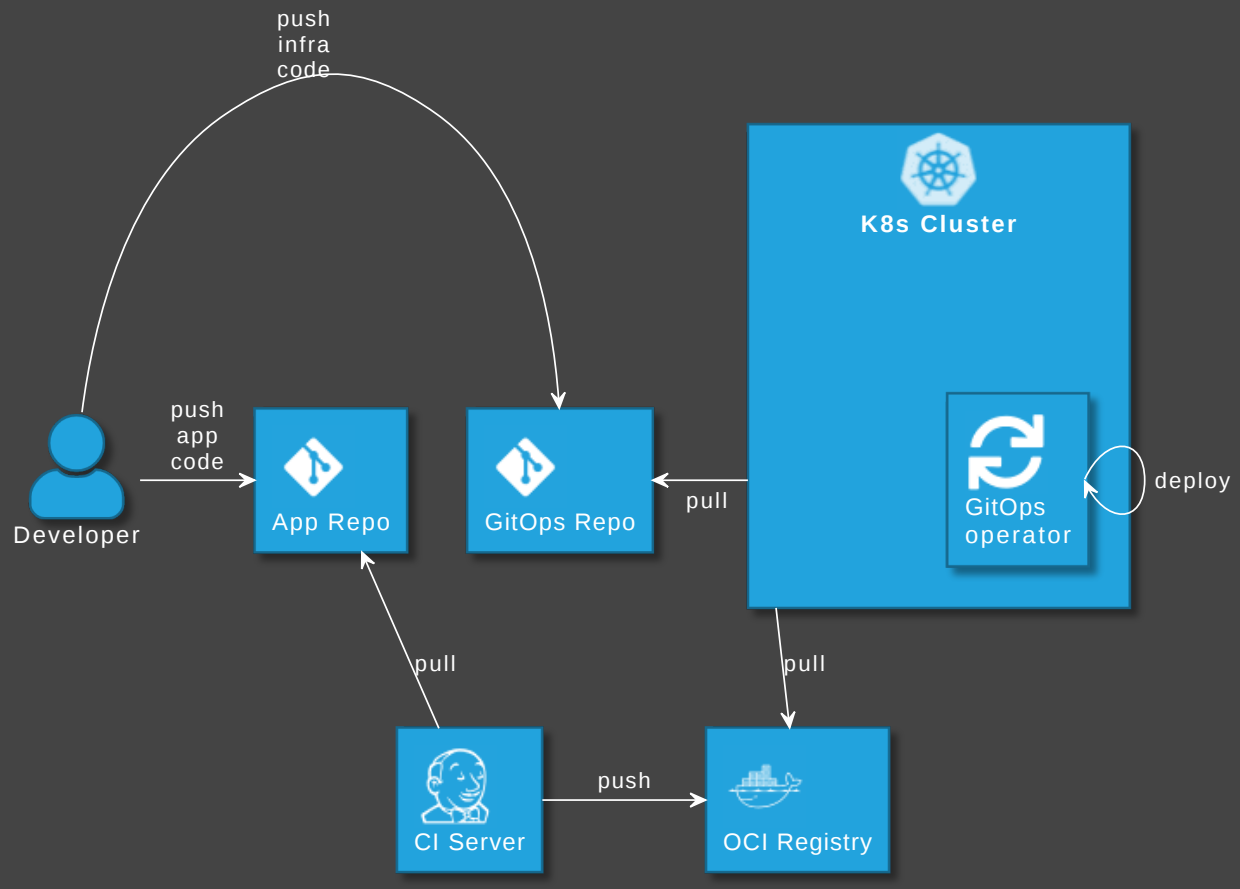
Basic role of CI server



Number of repositories: application vs GitOps repo

GitOps tools: Put infra in separate repo! See

🌐 argo-cd.readthedocs.io/en/release-2.0/user-guide/best_practices

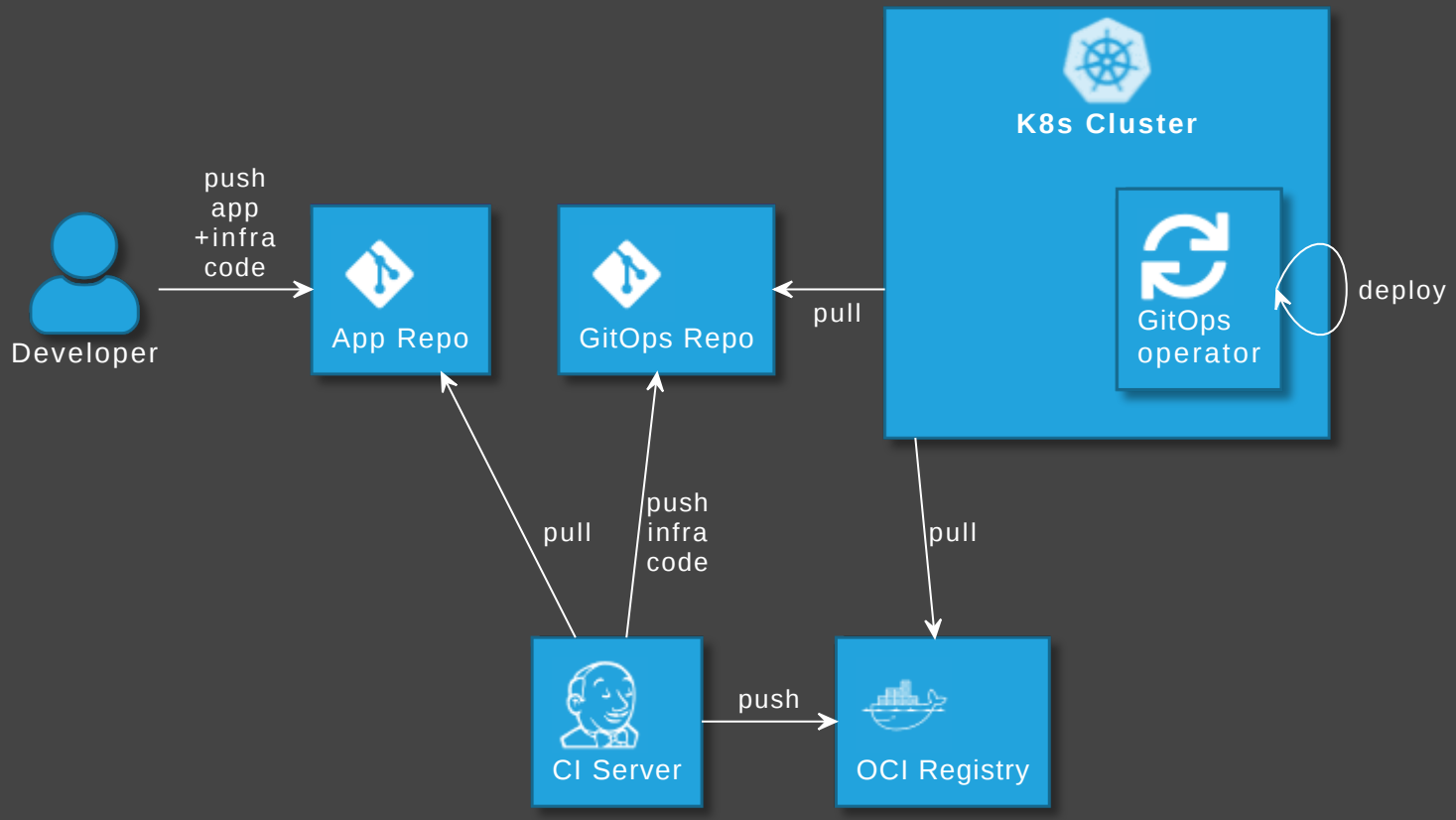


Disadvantages

- Separated maintenance & versioning of app and infra code
- Review spans across multiple repos
- Local dev more difficult

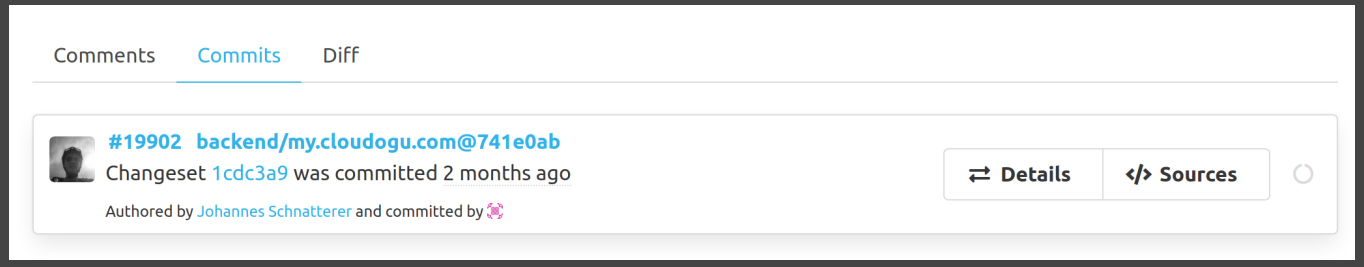
How to avoid those?

Extended role of CI server



Advantages

- Single repo for development: higher efficiency
- Automated staging (e.g. PR creation, namespaces)
- Shift left: static code analysis + policy check on CI server, e.g. yamlint, kubeval, helm lint, conftest
- Simplify review by adding info to PRs



cloudogu/gitops-build-lib

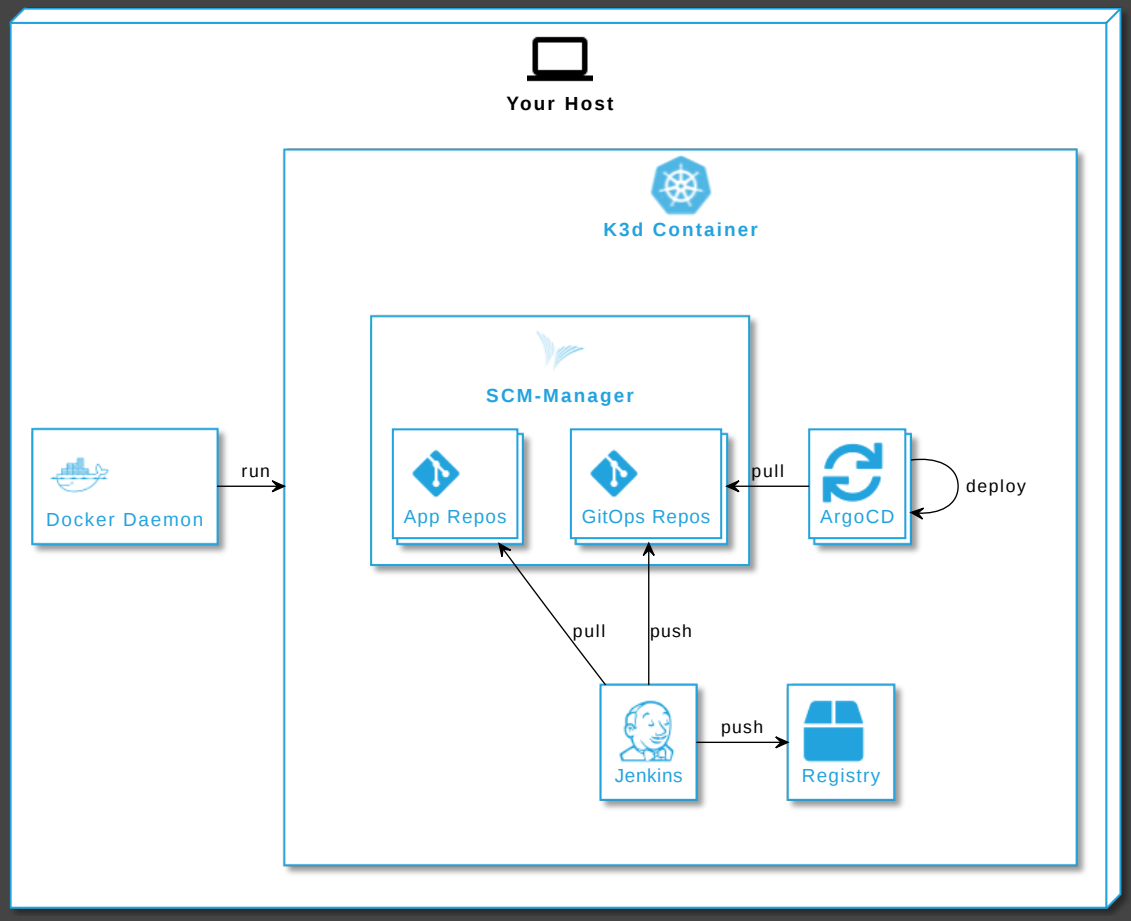
Local development

- Option 1: Deploy GitOps operator and Git server on local cluster
  ➡️ complicated
- Option 2: Just carry on without GitOps.
  Easy, when IaC remains in app repo

How to delete resources?

- "garbage collection" (Flux) / "resource pruning" (ArgoCD) disabled by default
- 📌 Enable from beginning ➡️ avoid manual interaction

Demo



cloudogu/gitops-playground

CONCLUSION

Personal Conclusion

After migrating to and operating with GitOps in production for > 1 year

- Smoother CI/CD,
  - *everything* declarative
  - faster deployment
- But: security advantages only when finished migration

GitOps experience distilled

+ Has advantages, once established

— Mileage for getting there may vary

Adopt GitOps?

- Greenfield
  - AppOps: Definitely
  - ClusterOps: Depends
- Brownfield: Depends

Johannes Schnatterer, Cloudogu GmbH

🌐 cloudogu.com/gitops

- ℹ️ GitOps Resources (intro, our articles, etc.)
- Links to GitOps Playground and Build Lib
- 💬 Discussions
- 👩‍🏫 Trainings

Slides

Image sources

- What is GitOps? https://pixabay.com/illustrations/question-mark-important-sign-1872665/
- How can GitOps be used? Tools: https://pixabay.com/photos/tools-knives-wrenches-drills-1845426/
- What challenges arise with GitOps? https://unsplash.com/photos/bJhT_8nbUA0