



# // GITOPS: INTRODUCTION TO CONTINUOUS OPERATIONS WITH KUBERNETES

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# Agenda

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

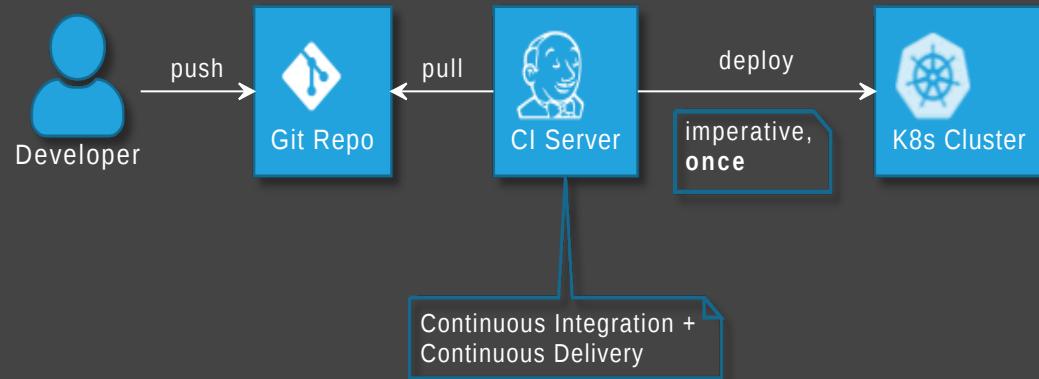
# What is GitOps?

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

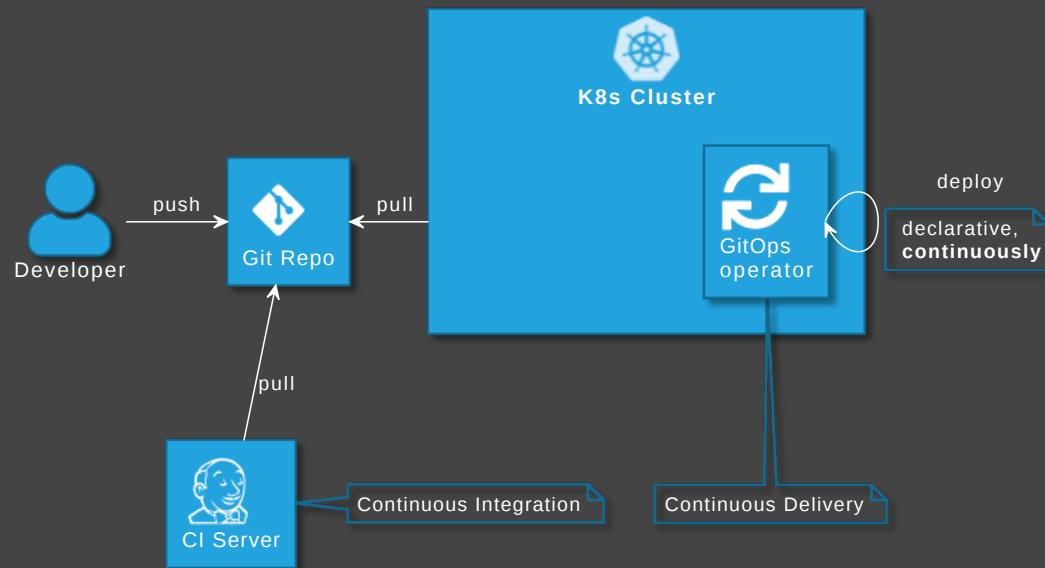
Use developer tooling to drive operations

 [weave.works/blog/gitops-operations-by-pull-request](https://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](https://github.com/open-gitops/documents/blob/main/PRINCIPLES.md)

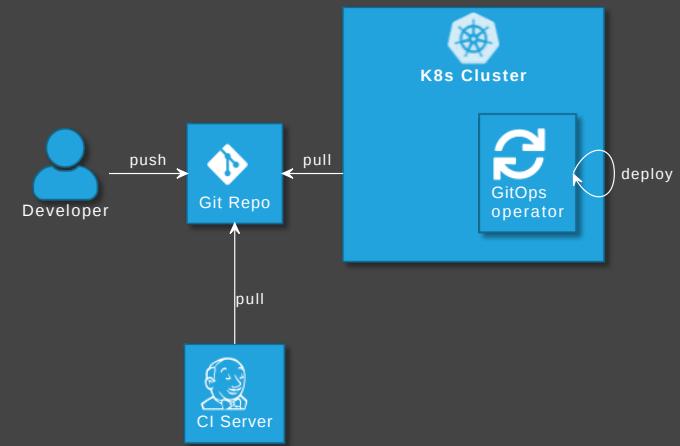


# GitOps vs DevOps

- 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

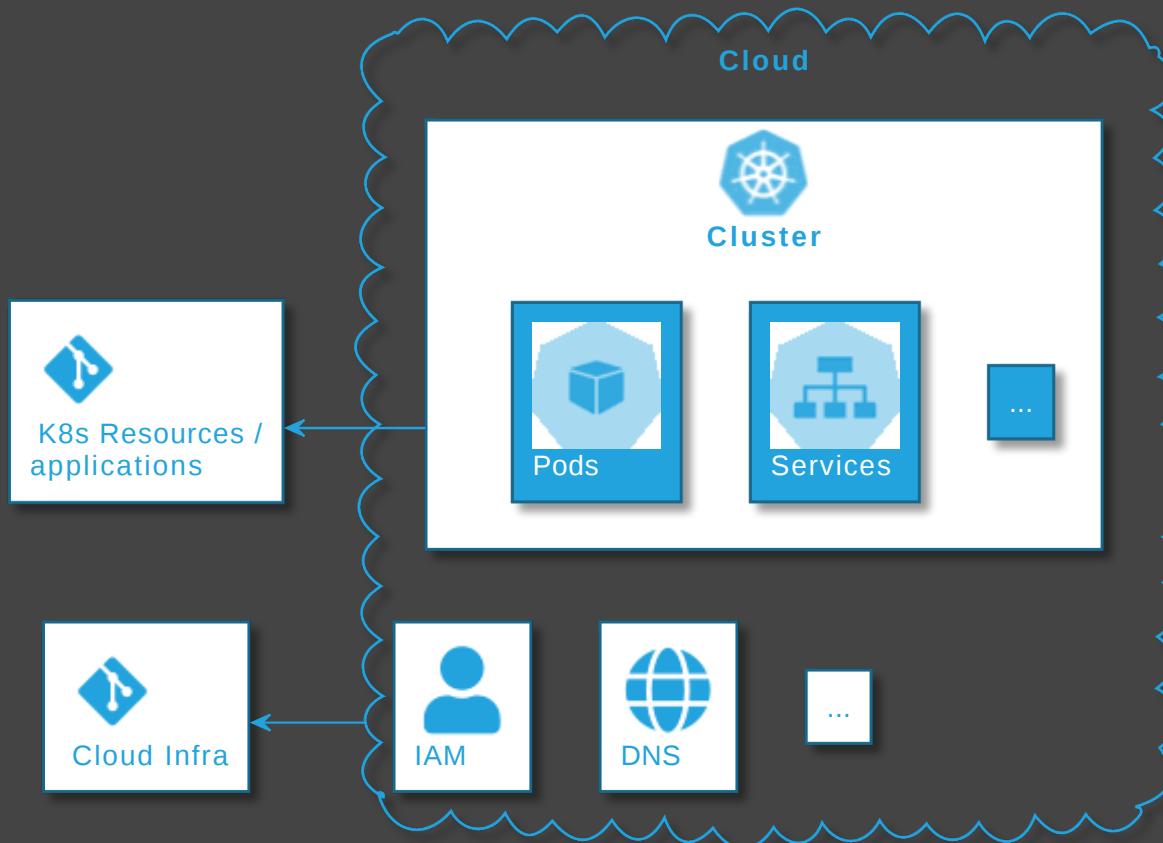
- No access to cluster from outside
  - ➔ No credentials on CI server
- Forces declarative description
- IaC is auditable
- Scalability - one repo many applications
- Self-healing / Hands-off ops





# 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

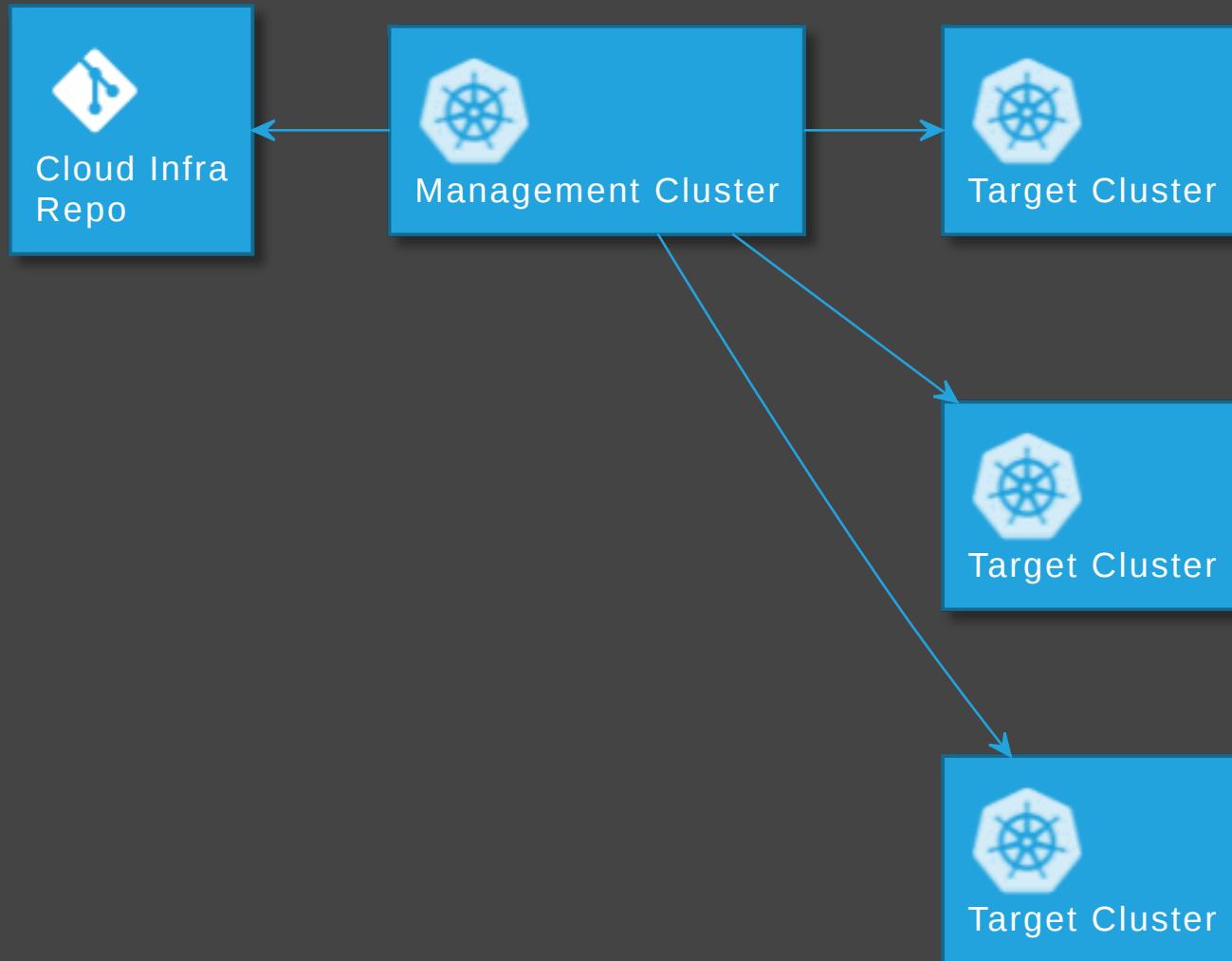
- Backup
- Deployment Strategies - Progressive Delivery

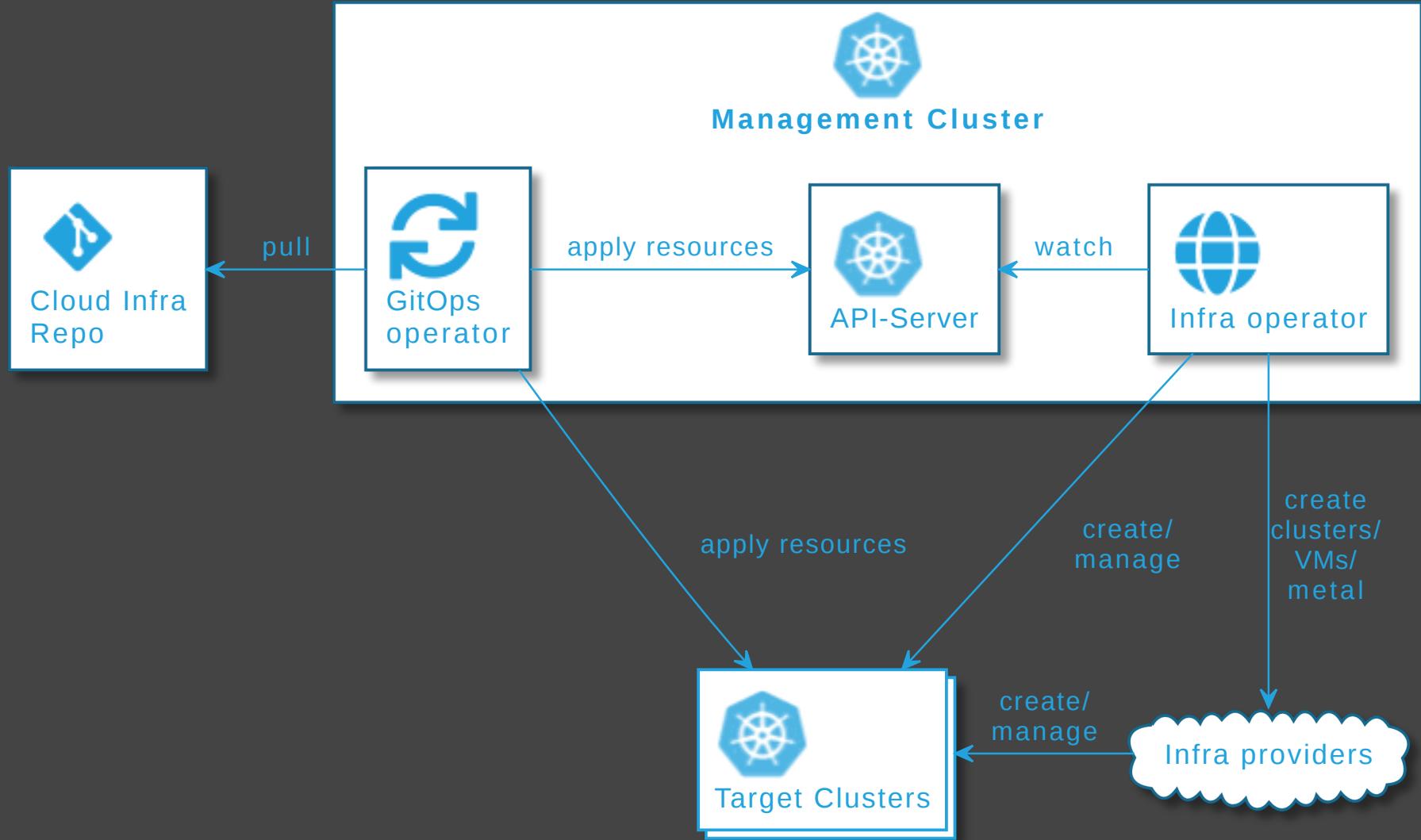


- ...

→ **GitOps loves operators**

# Operate Kubernetes with Kubernetes





# Tools for operating k8s clusters + cloud infra



+



-

Cloud or Operator

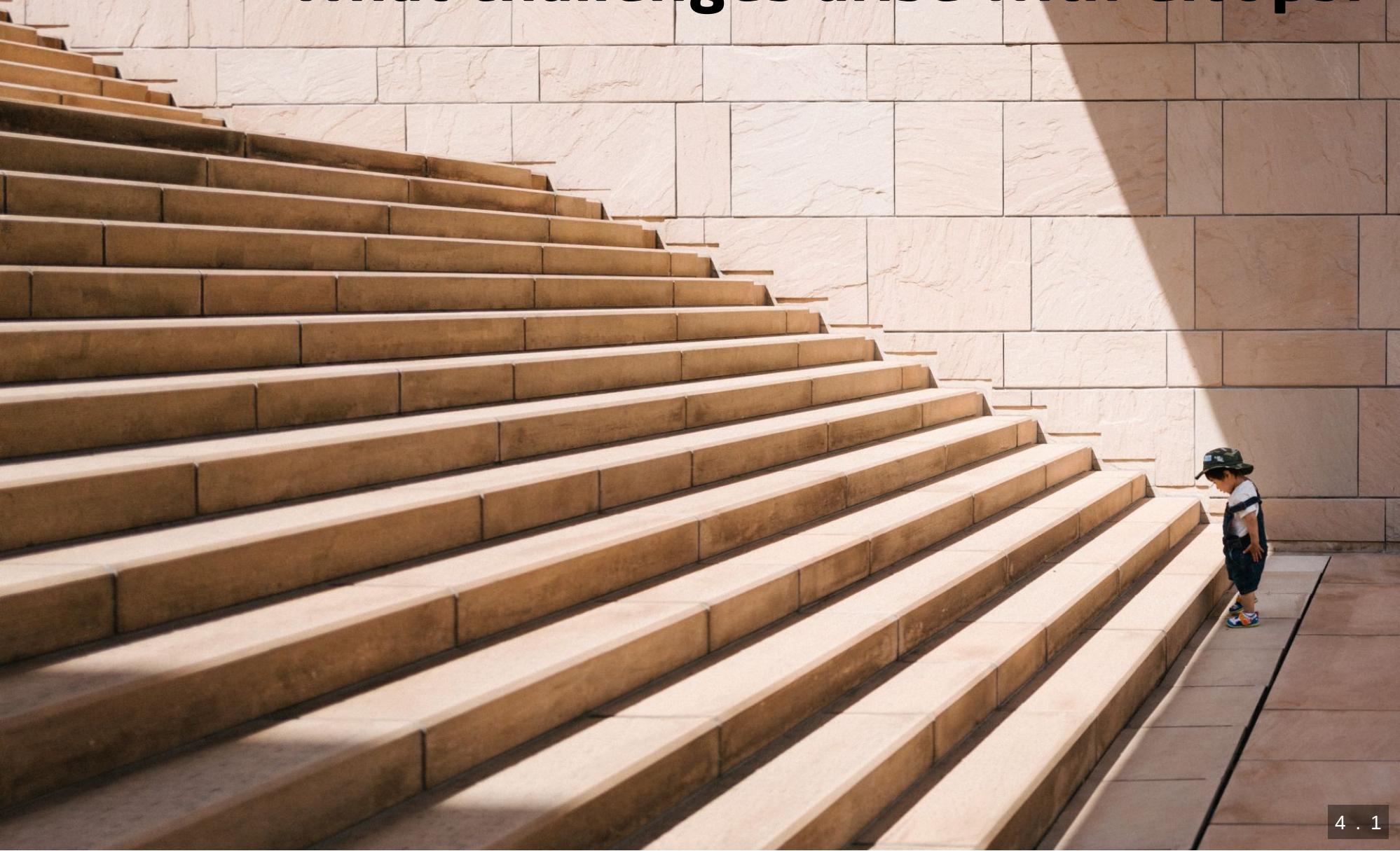
- 
- [rancher/terraform-controller](#)
-

## See also

 [cloudogu.com/blog/gitops-tools](https://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

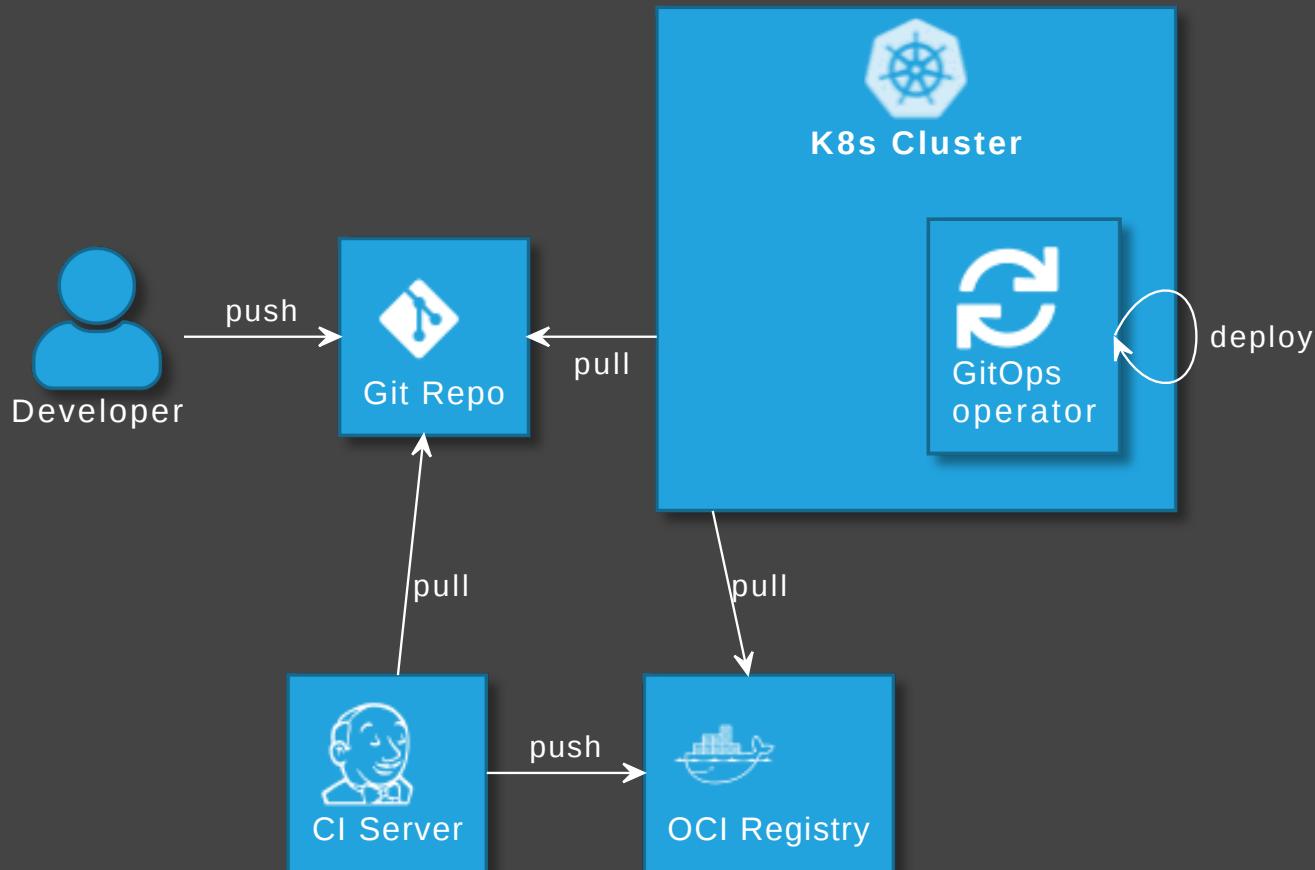
```
└── production
    └── application
        └── deployment.yaml
└── staging
    └── application
        └── deployment.yaml
```

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



- Logic for branching simpler
- Supports arbitrary number of stages

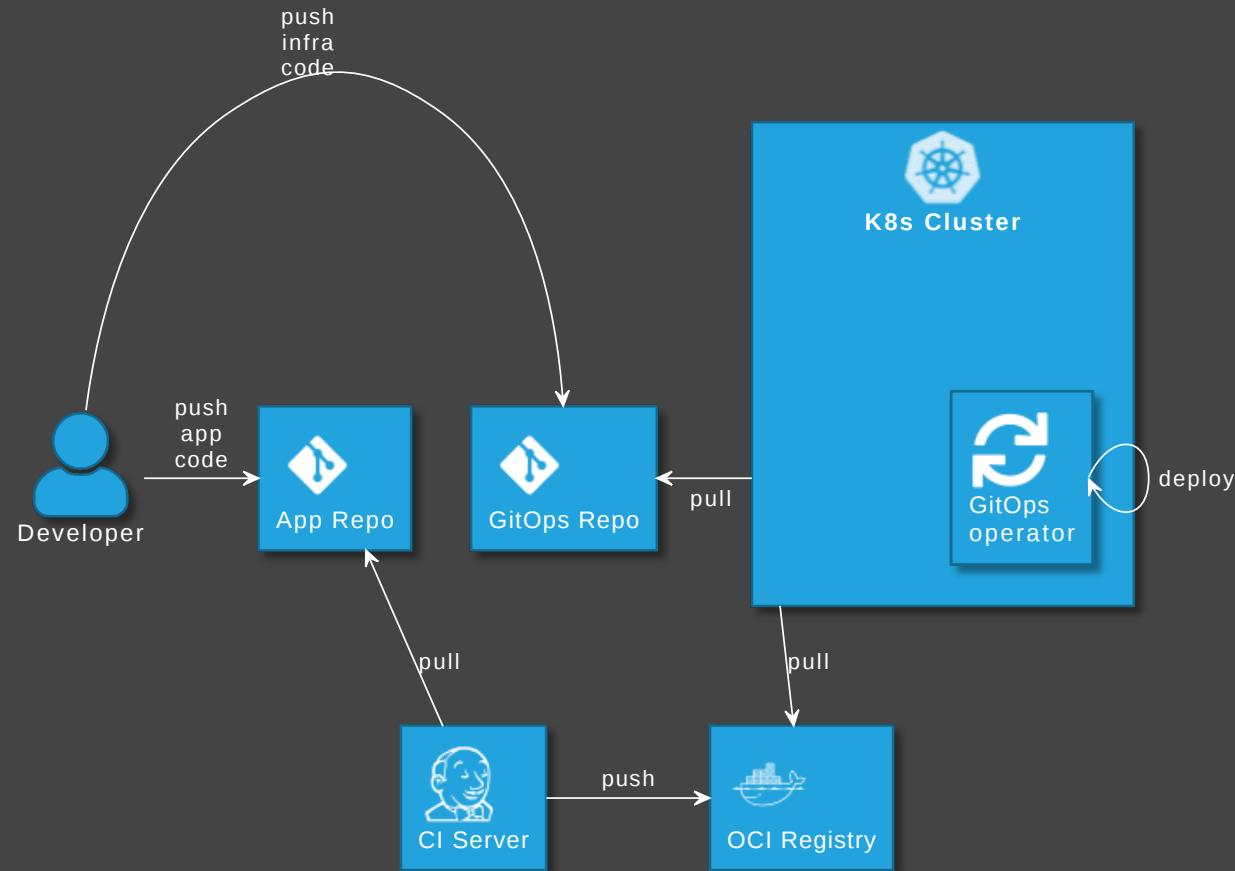
# Basic role of CI server



# 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](https://argo-cd.readthedocs.io/en/release-2.0/user-guide/best_practices)

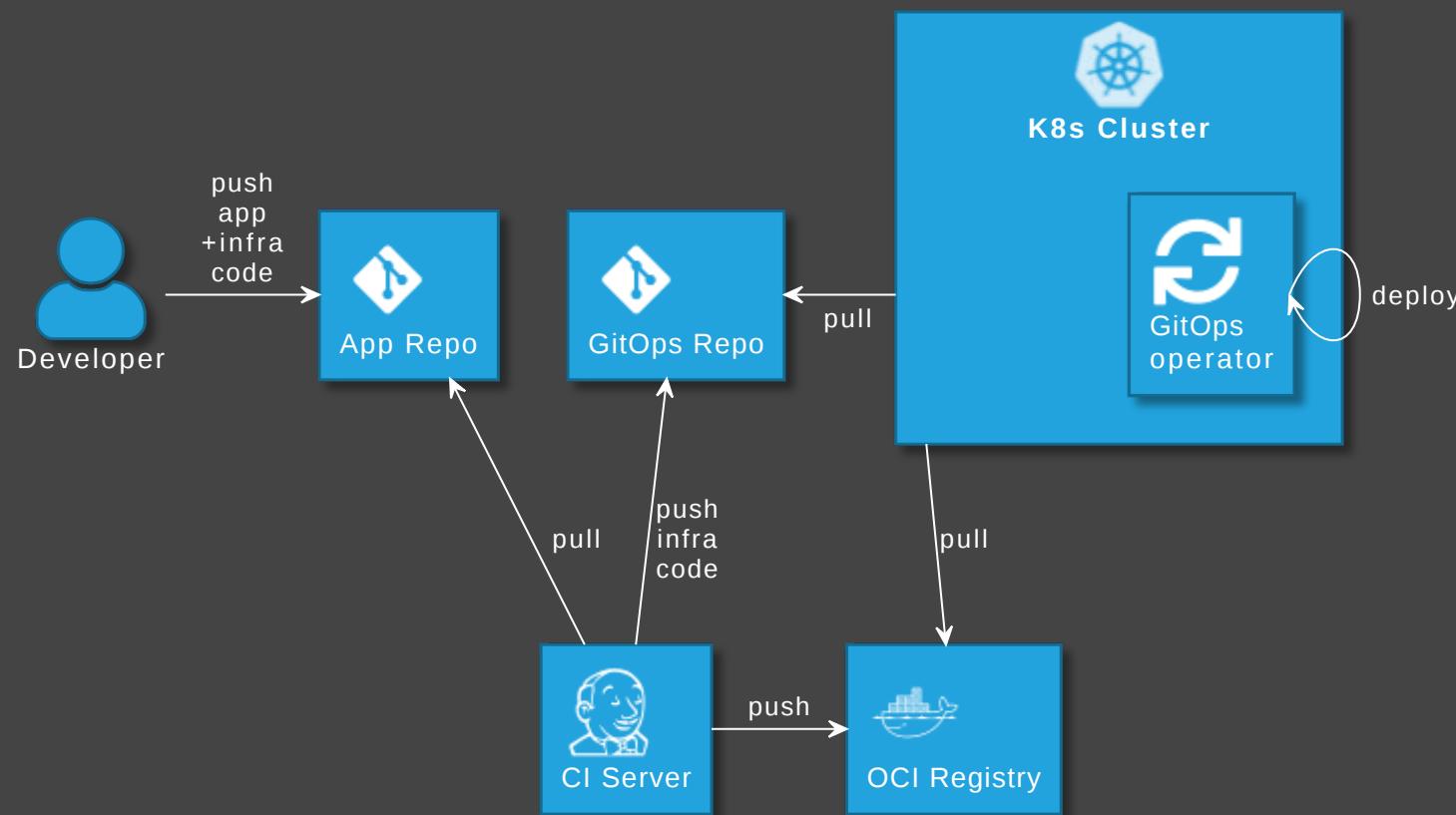


## **Disadvantages**

- 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

The screenshot shows a GitHub pull request details page. At the top, there are tabs for 'Comments', 'Commits' (which is underlined in blue), and 'Diff'. Below the tabs, a commit card is displayed for commit #19902. The commit message is: '#19902 backend/my.cloudogu.com@741e0ab'. It includes the text: 'Changeset 1cdc3a9 was committed 2 months ago'. Below this, it says 'Authored by Johannes Schnatterer and committed by 🍀'. To the right of the commit message, there are two buttons: 'Details' and 'Sources'. A small circular icon is also visible next to the 'Sources' button.

 [cloudogu/gitops-build-lib](#) 

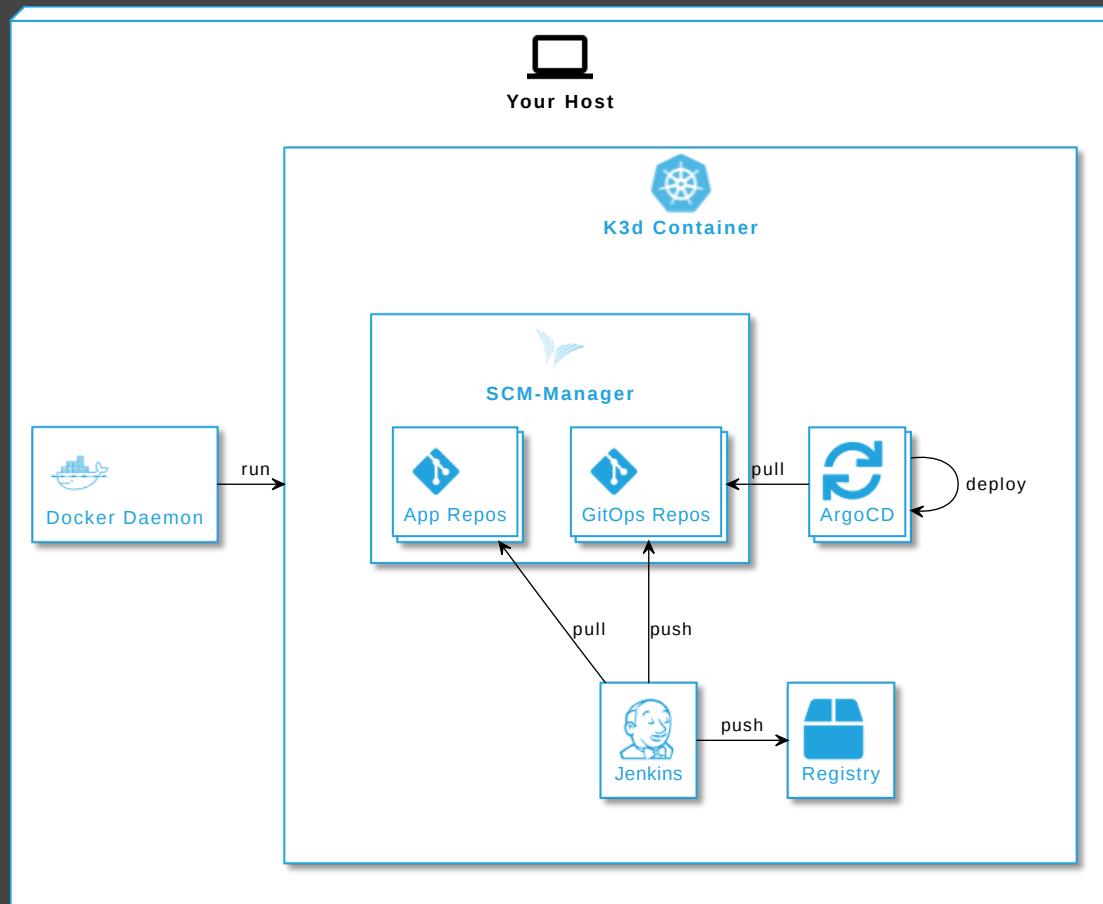
# Local development

- 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](https://github.com/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](http://cloudogu.com/gitops)

-  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](https://unsplash.com/photos/bJhT_8nbUA0)