// INTRODUCTION TO GITOPS – A NEW AGE OF AUTOMATION?

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Agenda

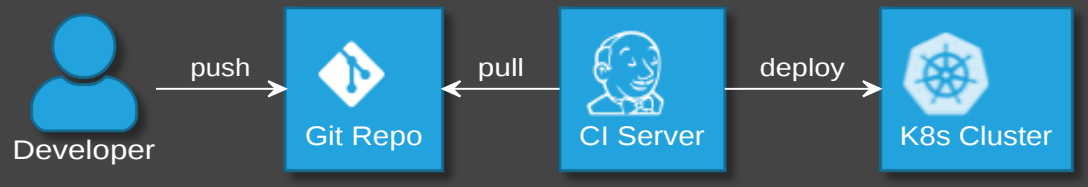
- What is GitOps?
- Where can it be used?
- How can it be used?
- What challenges arise?

What is GitOps?

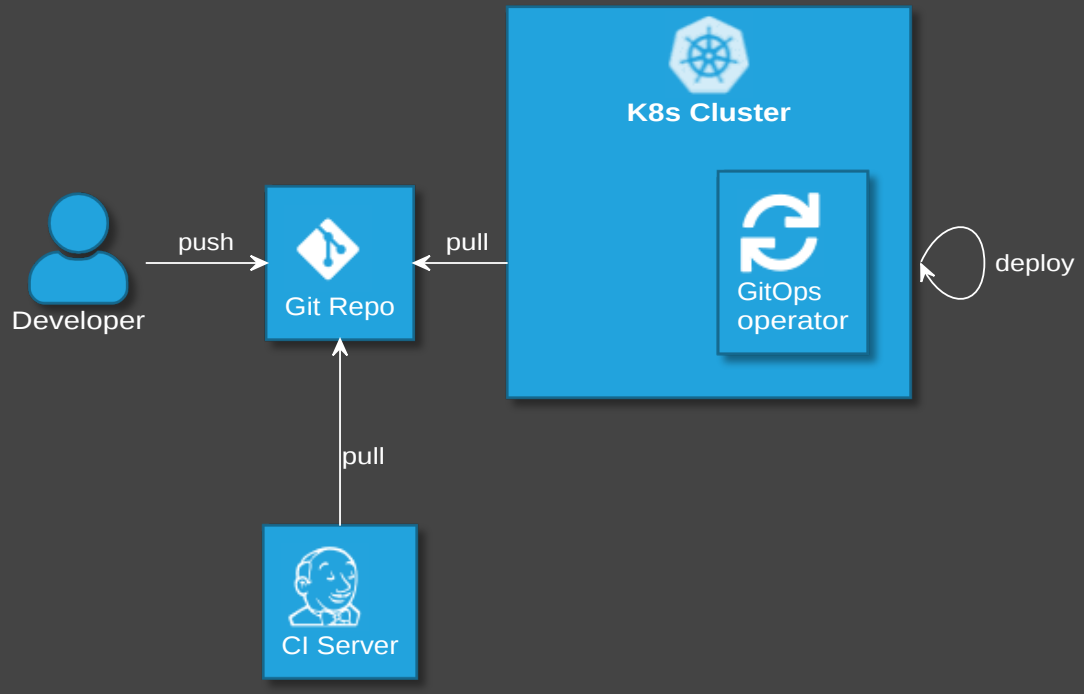
- Operating model
- Term (August 2017):

> 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 state reconciliation
4. The principle of operations through declaration

WIP!

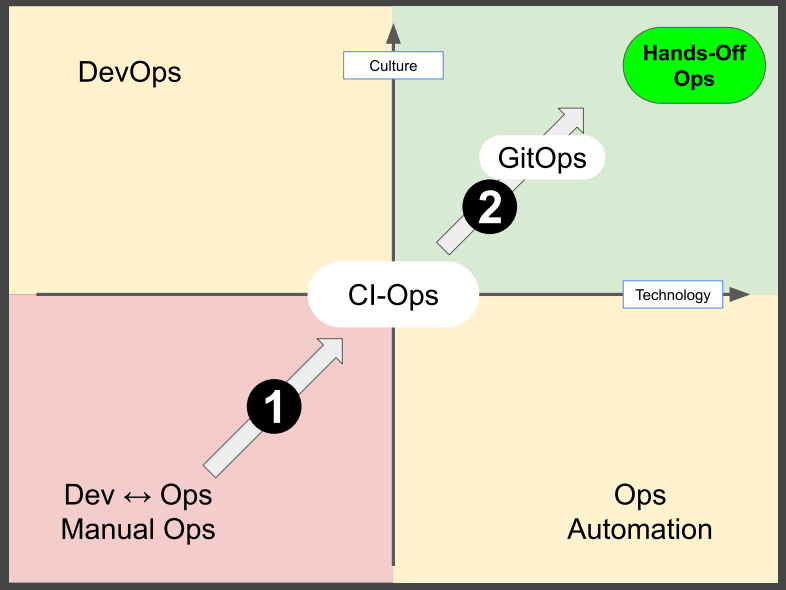
github.com/gitops-working-group/gitops-working-group/pull/48

hackmd.io/arwvV8NUQX683uBM3HzyNQem

GitOps vs DevOps

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

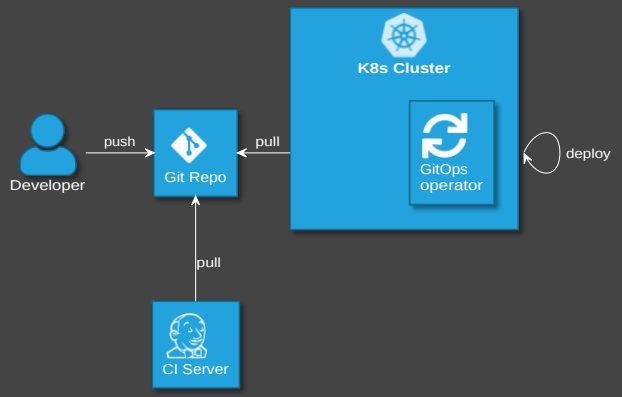
"The right way to do DevOps" (Alexis Richardson)



- 🎥 youtu.be/lvLqJW0ixDI
- 📰 heise.de/select/ix/2021/4/2032116550453239806 (iX 4/2021) 🇩🇪
- 🌐 schlomo.schapiro.org

Advantages of GitOps

- (Almost) no access to cluster from outside
- No credentials on CI server
- Forces 100% declarative description
  - auditable
  - automatic sync of cluster and git
- Enterprise: Accessing git is simpler (no new firewall rules)



What can GitOps be used for?

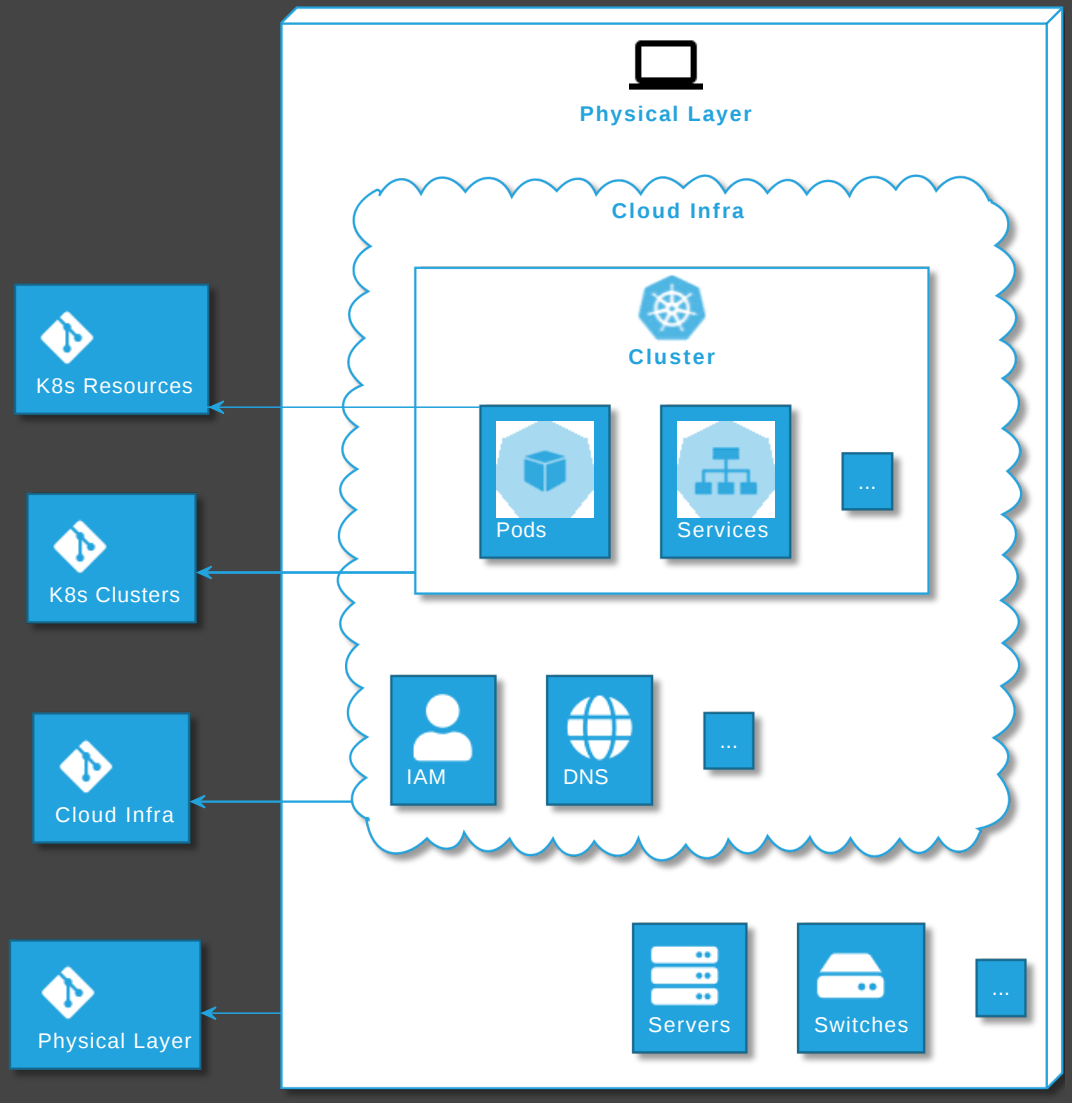
📜 GitOps History in a nutshell

- grew up operating applications on Kubernetes,
- is now rising above it, operating clusters and other (cloud) infrastructure

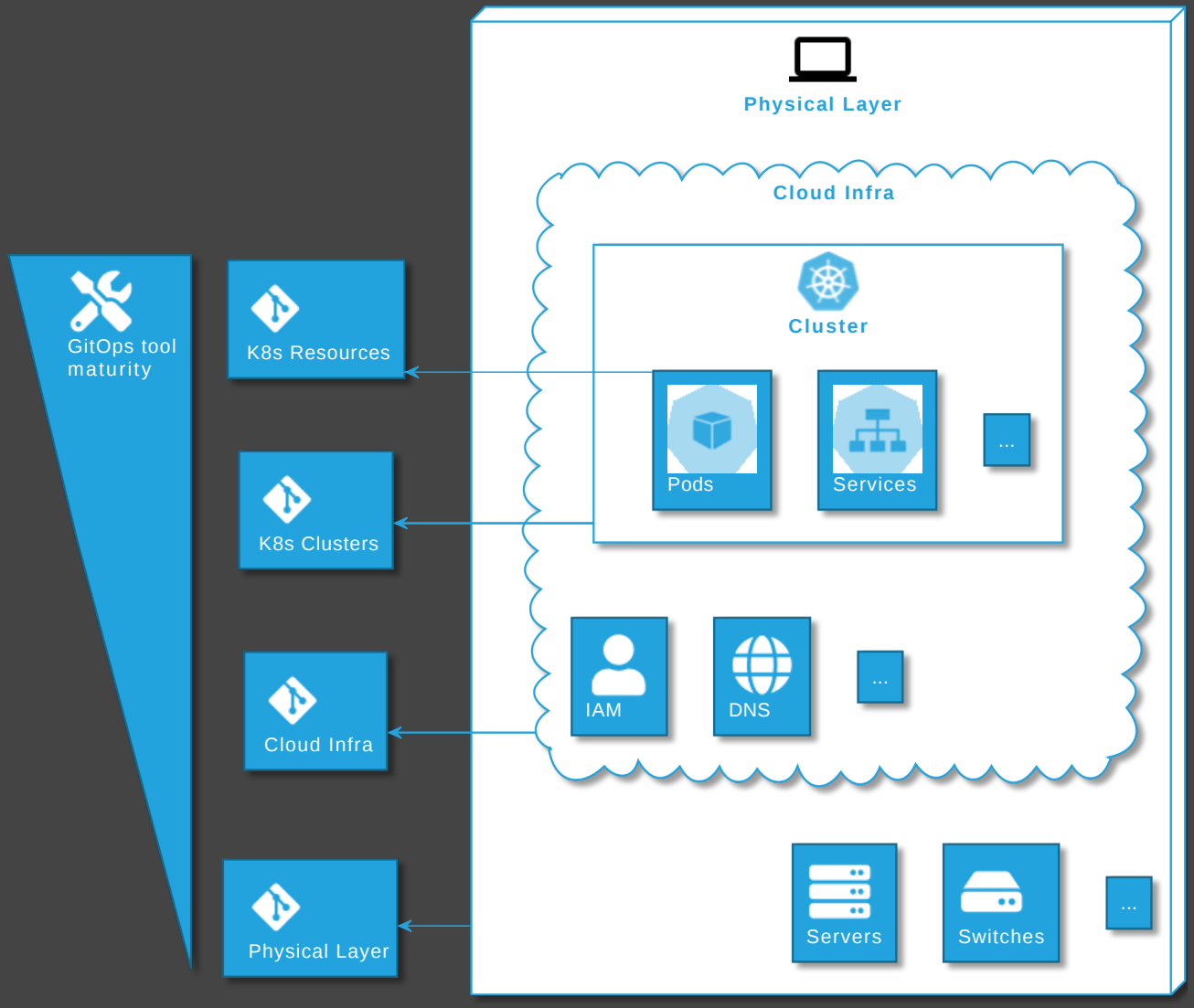
More on the history of GitOps:

🎥 https://youtu.be/IvLqJW0ixDI

A GitOps Dream



GitOps reality



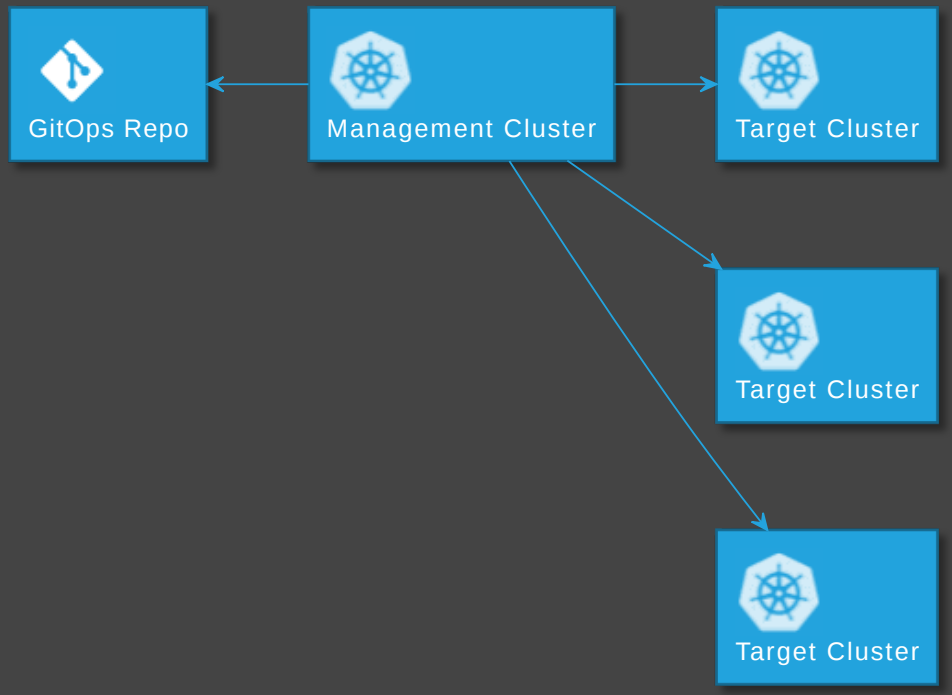

How can GitOps be used?
Tools

Categories

- Tools for Kubernetes AppOps
- Tools for Kubernetes ClusterOps
- Tools Close to Infrastructure
  - with or
  - without Kubernetes
- Supplementary GitOps tools

GitOps Tools for Kubernetes AppOps

Operate Kubernetes with Kubernetes



GitOps Tools for Kubernetes ClusterOps

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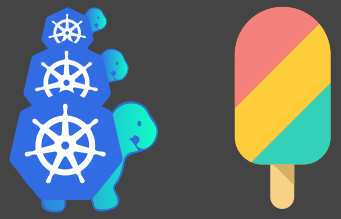

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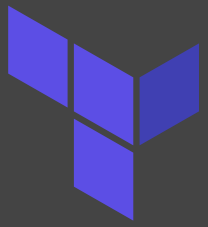
- hashicorp/terraform-k8s
- rancher/terraform-controller

Tools Close to Infrastructure

- with Kubernetes





+ Operators

- without Kubernetes


Supplementary GitOps tools

Secrets

- bitnami-labs/sealed-secrets
- mozilla/sops + K8s integration
  - isindir/sops-secrets-operator
  - jkroepke/helm-secrets (plugin)
  - flux v2 (native support)
- Soluto/kamus
- Operators for Key Management Systems
  - external-secrets/kubernetes-external-secrets
  - ContainerSolutions/externalsecret-operator
  - ricoberger/vault-secrets-operator

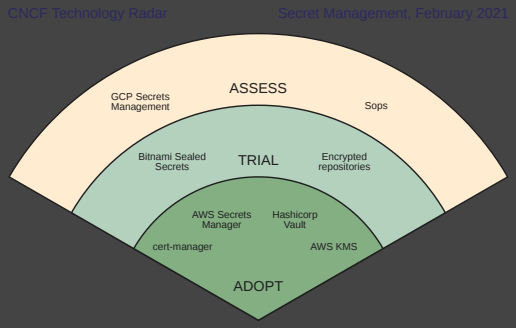
Others

- Deployment Strategies - Progressive Delivery


- Backups
- Horizontal Pod Autoscaler
- ...

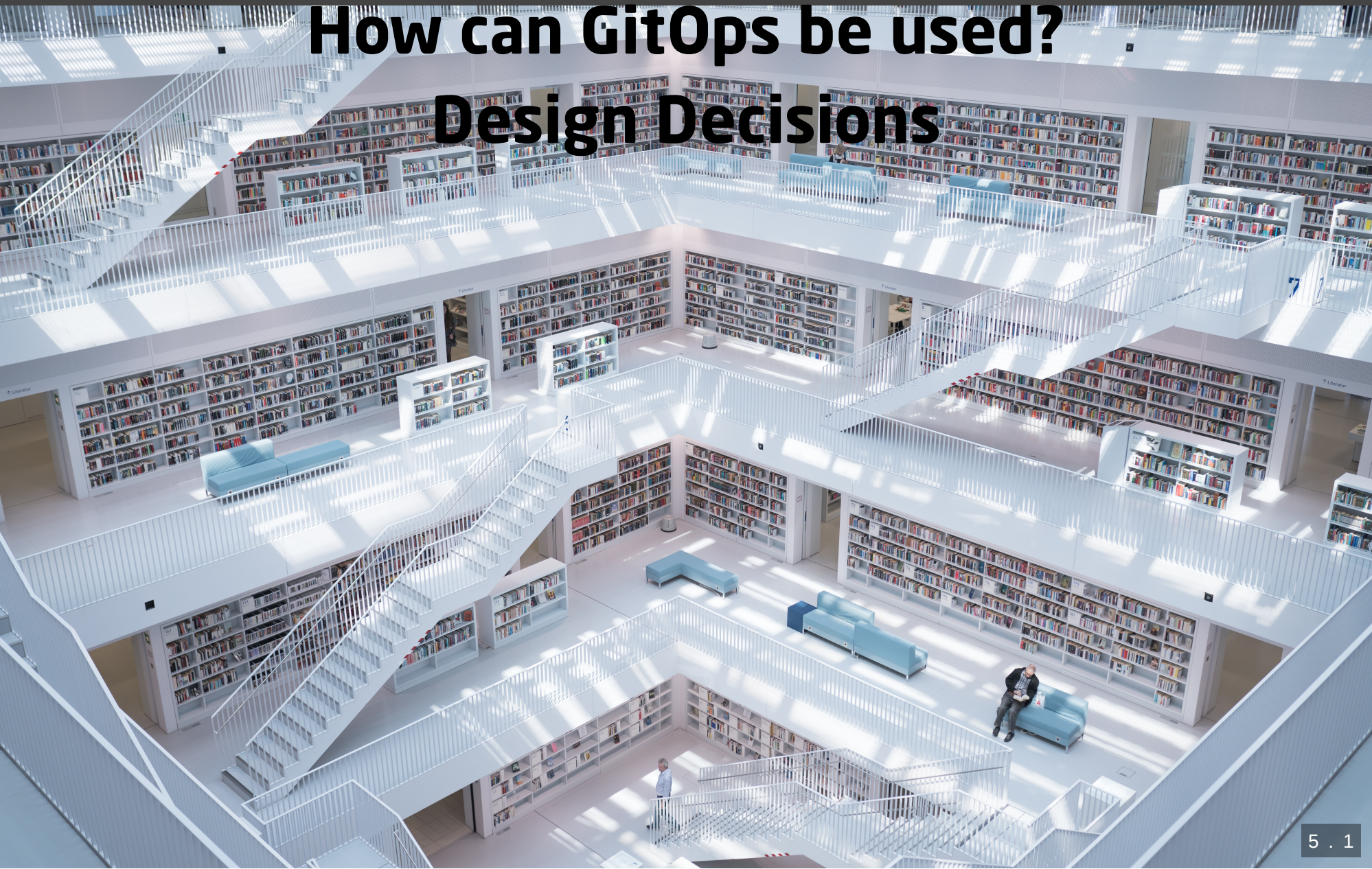
See also

- ☁ cloudogu.com/blog/gitops-tools (iX 4/2021)
  - General tool comparison,
  - tips on criteria for tool selection,
  - comparison of ArgoCD v1 and Flux v2
- 🌐 radar.cncf.io/2021-02-secrets-management
-  weaveworks/awesome-gitops
- 🌐 gitops.tech



How can GitOps be used?

Design Decisions



- Implementing stages
- Role of CI server
- Number of Repos
- ...

Implementing stages

Idea 1: Staging Branches

- Develop ➡️ Staging
- Main ➡️ Production

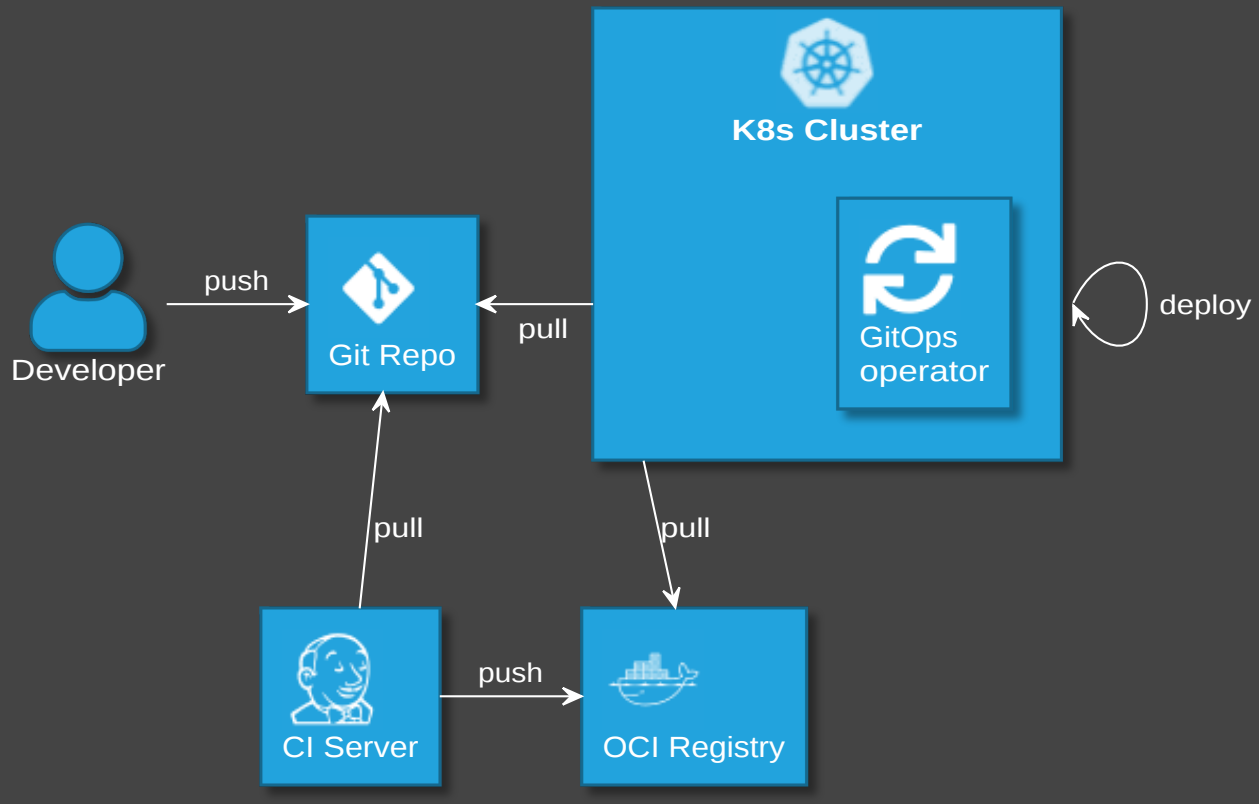
Logic for branching complicated and error prone (merges)

Idea 2: Staging folders

- On the same branch: One folder per stage
- Explicit namespace in resource YAMLs, if necessary
- Process: Just commit to staging folder, create PRs for prod
- Risky, but can be automized

- Logic for branching simpler
- Supports arbitrary number of stages

Role of CI server



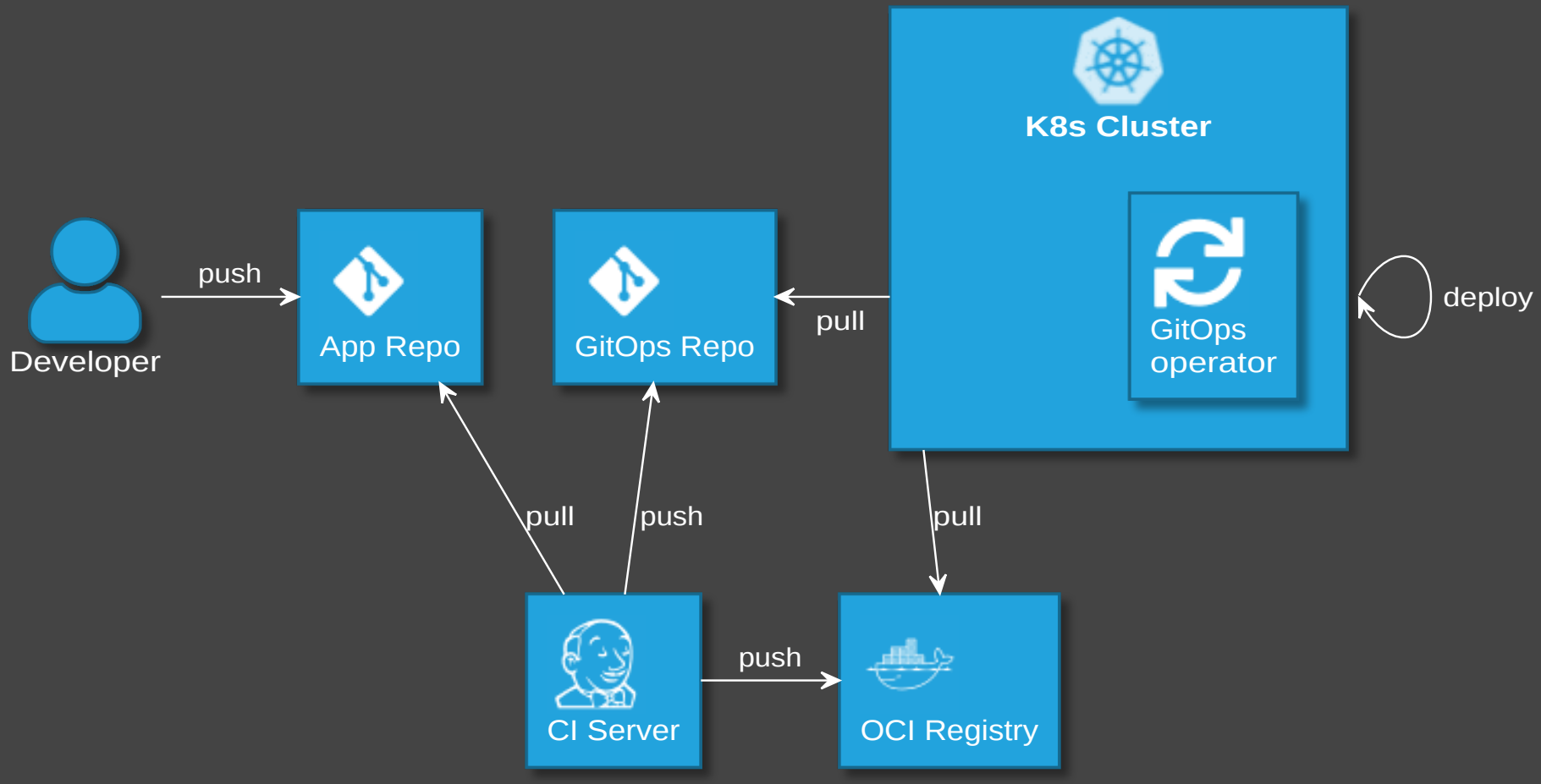
Application repo vs GitOps repo

- Good pratice: Keeping everything in app repo (code, docs, infra)
- GitOps: Put infra in separate repo?

  Disadvantages:
  - Separated maintenance
  - Separated versioning
  - Review spans across multiple repos
  - Local dev more difficult

Can’t we have both?

Yes, we can! Using a CI-Server



Disadvantages

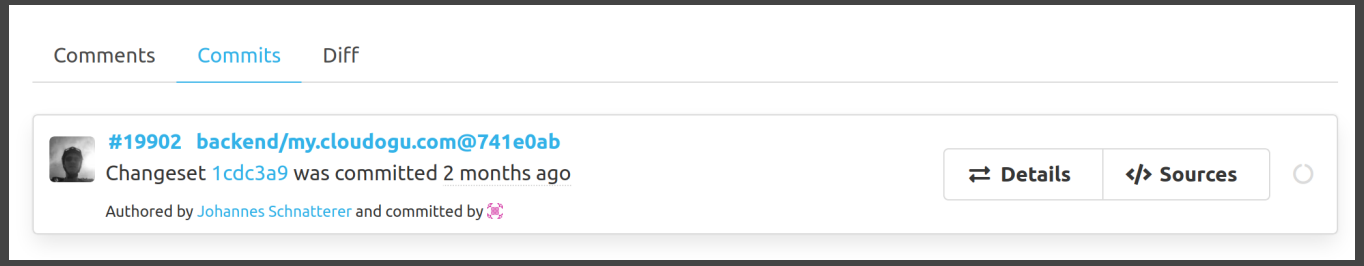
- Complexity
- Efforts for developing CI pipelines
- A lot can go wrong. Examples
  - Git Conflicts caused by concurrency
  - Danger of inconsistencies

➡️ Recommendation: Use a plugin or library

Example: cloudogu/gitops-build-lib

Advantages

- Fail early: static YAML analysis on CI server,
  e.g. yamlint, kubeval, helm lint
- Automated staging (e.g. PR creation, namespaces)
- Use IaC for development environment
- Write config files not inline YAML
  ➡️ Automatically converted to configMap
- Simplify review by adding info to PRs



Demo

cloudogu/k8s-gitops-playground

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

- 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.)
- Resource consumption
- Maintenance/patching
- Vendor support necessary

Day two questions

- POC is simple
- Operations in prod has its challenges
  - How to structure repos?
  - How to realize staging?
  - How to delete resources?
  - How to realize local dev env?
  - ...

How to delete resources?

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

Local development

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

CONCLUSION

Personal Conclusion

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

- Smoother CI/CD,
  - *everything* declarative
  - faster deployment
  - force sync desired state ↔️ actual state
- But: security advantages only when finished migration
- A lot of potential ahead!

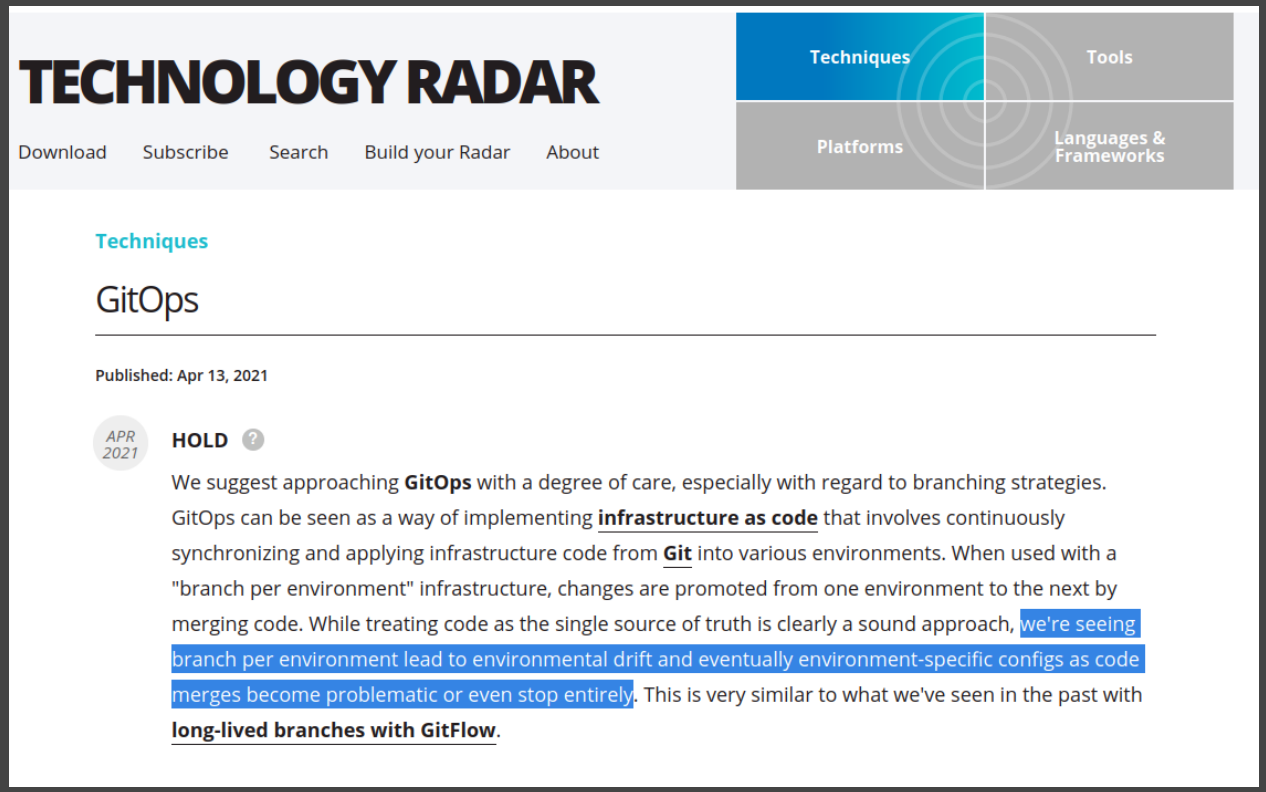
GitOps experience distilled

+ Has advantages, once established

— Mileage for getting there may vary

Adopt?

- Greenfield
  - Kubernetes AppOps: Definitely
  - Cloud Infra: Depends
- Brownfield: Depends



🌐 thoughtworks.com/radar/techniques/gitops

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🌐 cloudogu.com/gitops

- ℹ️ GitOps Resources (intro, tool comparison, etc.)
- Links to GitOps Playground and Build Lib
- 💬 Discussions
- 👩‍🏫 Training

Slides