GitOps for a global team

Craig Dillon
Technological University Dublin
x00205790@mytudublin.ie
MSc. DevOps
Human and Organisational Skills
CA3 Briefing Document

Contents

1 Introduction **3**
1.1 Current challenges . . . 3
1.2 What is GitOps . . . 3

2 GitOps in Detail **3**
2.1 Principles of GitOps . . . 3
2.2 GitOps workflow . . . 4
2.3 Tooling . . . 4
2.4 Benefits of GitOps . . . 4

3 Business benefits of GitOps **5**
3.1 Cost savings and efficiency gains . . . 5
3.2 Infrastructure Cost Optimization . . . 5
3.2 Enhanced Security and Compliance . . . 5
3.3 Rapid Incident Response and Rollback . . . 6
3.4 Traceability of changes . . . 6
3.4 Improved collaboration . . . 6
3.5 Quantifiable metrics . . . 6

4 Financial costs and benefits of GitOps **6**
4.1 Estimated costs . . . 6
4.1.1 Training and onboarding . . . 7
4.1.2 Initial implementation costs . . . 7
4.1.3 Running costs . . . 7
4.2 Anticipated benefits . . . 7
4.3 ROI Metrics . . . 7

References **9**

Appendices **10**
Appendix A: Tables & figures . . . 10

Introduction

Current challenges

The decision to form a global team reflects the organisations drive towards embracing the diverse and specialised skillsets available. This change does bring risks and challenges, such as;

- Siloed workflows
- Divergent development methodologies
- Different management methodologies
- Security and compliance risks

This creates a requirement for the newly formed team to follow the same processes to ensure a successful, harmonious future.

What is GitOps?

"GitOps is an operational framework that takes DevOps best practices used for application development such as version control, collaboration, compliance, and CI/CD, and applies them to infrastructure automation." What is GitOps? | GitLab (n.d.)

GitOps in detail

Principles of GitOps

GitOps is a set of practices that relies on version control systems, like Git, to manage infrastructure and application deployments. The core principals of GitOps are based on the concept that systems are managed using declarative code that maintains their state. *The three main pillars of GitOps are:*

- *Git is the single source of truth*
- *Treat everything as code*
- *Operations are performed through Git workflows*

Vinto & Bueno (2022) The GitOps Principles are defined as;

- *Declaritive - A system managed by GitOps must have its desired state expressed declaratively.*
- *Versioned and immutable - The desired state is stored in a way that enforces immutability and versioning retains a complete version history.*
- *Pulled automatically - Software agents automatically pull the desired state declarations from the source*

Vinto & Bueno (2022)

GitOps workflow

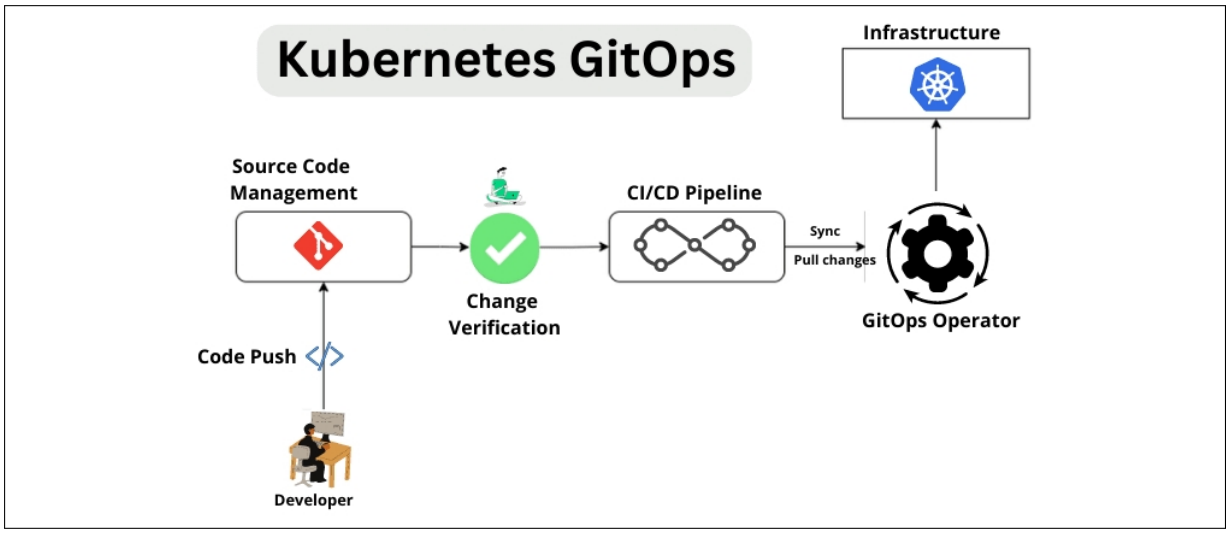

Figure 1: An example GitOps workflow (Source: *Kubernetes GitOps: A Beginner's Guide with a Hands-On Tutorial* (2023))

Tooling

Consistent, globally available tooling is crucial for the successful adoption of GitOps and should align with the teams workflows, promote collaboration and improve the efficiency of continuous delivery and infrastructure management. The following is the suggested tooling;

- Version control - GitLab
- GitOps orchestration - Argo CD
- Infrastructure as code - Terraform, Crossplane, Ansible and Helm
- CI/CD - GitLab CI/CD
- Monitoring and observability - Prometheus, Grafana
- Security scanning - OWASP security scanning, GitLab SAST
- Stress testing - Grafana K6
- Collaboration and documentation - GitLab wiki, GitLab issue tracking, Slack

Benefits of GitOps

GitOps builds on the principles of DevOps and provides a number of advantages, such as;

- Improved collaboration

- Source and version control provides consistent infrastructure and reduces configuration drift
- Reduced manual intervention with improved release cycle times and increased stability
- Improved resilience through rollback methods, faster recovery from issues resulting in less downtime
- High visibility with code reviews and encourages knowledge sharing
- Improved security by implementing consistent security, governance and compliance measures
- Early issue detection and simpler troubleshooting process
- Familiarity with tooling

Business benefits of GitOps

Cost savings and efficiency gains

GitOps can bring improvements in efficiencies and as a result a reduction in cost. Crux Informatics report that they have achieved *"40% cost savings, increased developer productivity, and consistent deployments." Crux Informatics* (n.d.)
Further, the US Department of Defence (DoD) have achieved excellent security and compliance consistency as a result of adopting GitOps, *"This bakes-in security from the get go and allows a security first mindset even when developers are working on an MVP." How the DoD uses GitOps to bake in security* (n.d.)

Infrastructure Cost Optimization

GitOps practices streamline infrastructure management, ensuring optimal resource utilization. Continuous testing and early identification of issues lead to cost savings by preventing them from progressing to later, more expensive stages of development. GitOps enables scalability of serverless resources which means that costs are dynamic and scale with demand rather than relying on static infrastructure costs.

Enhanced Security and Compliance

Automated security checks in the GitOps pipeline prevent vulnerabilities from progressing to production, reducing the risk of security breaches. There is also better visibility and control of changes which creates improved access controls and comprehensive audit trails.
Automated checks for compliance standards during the CI/CD pipeline reduce the risk of non-compliance. A unified approach to compliance across global teams ensures consistency and adherence to regulatory requirements.

Rapid Incident Response and Rollback

GitOps relies on a rollback method where the last known working Git commit can be automatically rolled back if required. Quick recovery minimizes downtime, ensuring that business operations remain uninterrupted and reduces the financial cost of outages.

Transparency and Auditability

GitOps provides a transparent and auditable change history, allowing stakeholders to trace changes back to specific commits. This traceability is crucial for compliance audits and investigations.

Improved Collaboration

Using Git as the single source of knowledge provides teams with a collaboration hub. This means that issues can be assigned, merge requests and code can be reviewed and discussed within a single space.

Quantifiable metrics

Relying on Git as the single source of information, collaboration and resources means that metrics can also be gathered from a single source. Gitlab supports measurement of DORA (DevOps Research and Assessment) metrics which are divided into two core areas;

- Deployment frequency and lead time for changes measure team velocity
- Change failure rate and time to restore measure stability

Other KPIs that can be employed to create a larger picture are;

- Repository activity
- Repository health, consistency and cleanliness
- SLA targets
- Collaboration index
- Security scans and number of findings per deployment

Financial costs and benefits of GitOps

Estimated costs

Costing can be broken down into three categories, training and onboarding, initial implementation costs and running costs.

Training and onboarding

The existing teams have a variety of expertise in the planned solution. Some teams have experience with Infrastructure as Code, others using GitLab for pipelines, training will need to be adjusted to meet these different requirements to have the newly formed team at the same level of knowledge across the technology stack. There is also an opportunity to recruit experts where needed to bolster the new team.

- Training costs, estimated at €80,000
- Recruitment, allocating €250,000 for recruitment would allow us to hire 2 or 3 people with extensive knowledge in specialised fields

Initial implementation costs

Implementation and planning will consume a significant number of person hours including input from engineers, project managers, management and security and governance specialists. There would be an estimated cost in the region of €350,000 in respect to a successful implementation.

Running costs

Annual running costs can be broken down into the platforms and tooling used to support GitOps. This does not take into consideration the salary costs of existing employees that will form part of the team.

- GitLab Ultimate subscription €9,000 per year
- Cost of managed 6 Kubernetes clusters, €15,000 per year
- Slack Pro subscription at €4,000 per year

Anticipated benefits

Our current infrastructure is spread across several global regions costing €70,000 annually for datacentre hosting, hardware purchases and maintenance and other hosting related tasks. Moving to Gitops provides the organisation with the same level of global coverage at the much lower cost of €28,000 annually. The reduction in latency in release cycles, recovery from incidents and achieving better results regarding SLAs will bring further financial benefits.

ROI Metrics

To measure the financial return on this investment, the following metrics can be measured;

- Infrastructure cost per application
- Deployment cost per release
- Time to market
- Deployment frequency
- New customer rates
- Frequency of downtimes and cost of missing SLA targets

References

Crux Informatics (n.d.). Accessed: 17/11/2023.
URL: *https://codefresh.io/case-studies/crux/*

How the DoD uses GitOps to bake in security (n.d.). Accessed: 17/11/2023.
URL: *https://www.weave.works/blog/how-the-department-of-defense-uses-gitops-to-bake-in-security*

Kubernetes GitOps: A Beginner's Guide with a Hands-On Tutorial (2023). Accessed: 17/11/2023.
URL: *https://dev.to/pavanbelagatti/kubernetes-gitops-a-beginners-guide-with-a-hands-on-tutorial-56de*

Vinto, N. & Bueno, A. (2022), *GitOps Cookbook*, O'Reilly Media.

What is GitOps? | GitLab (n.d.). Accessed: 16/11/2023.
URL: *https://about.gitlab.com/topics/gitops/*

Appendix A: Tables & figures

List of Figures

1 An example GitOps workflow (Source: *Kubernetes GitOps: A Beginner's Guide with a Hands-On Tutorial* (2023)) 4

List of Tables