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KubeCon Europe | August 2020

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# Where Is My Container?

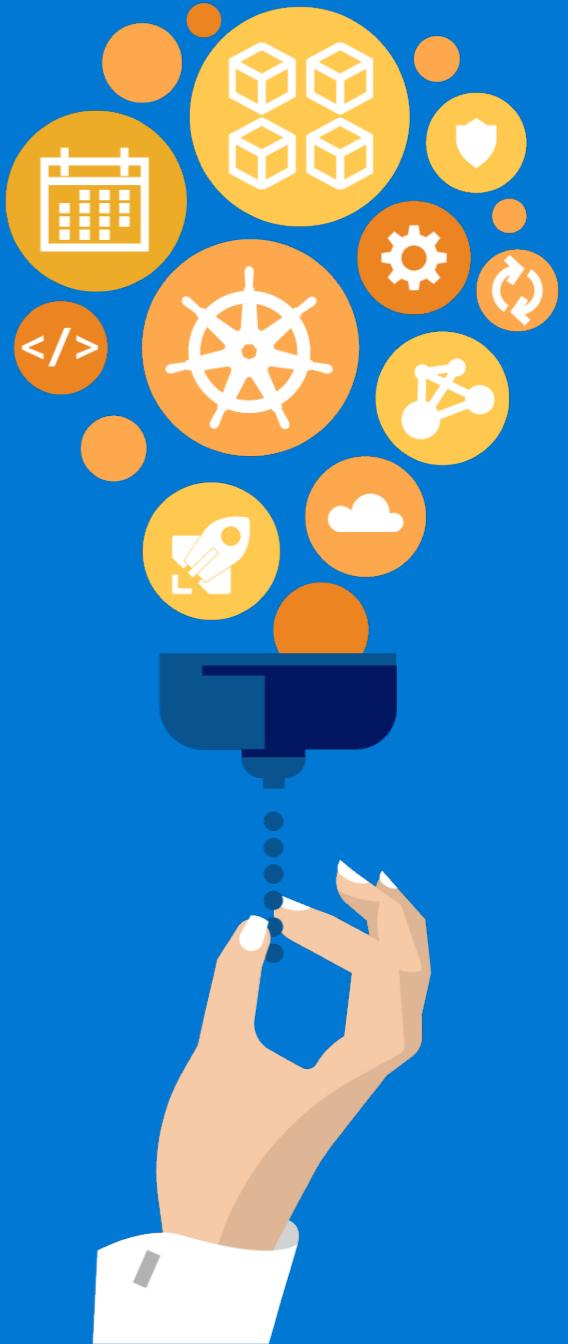
*Visualizing the GitOps Container Journey*

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# Introduction



Andre Briggs  
Engineering Manager at  
**Microsoft**



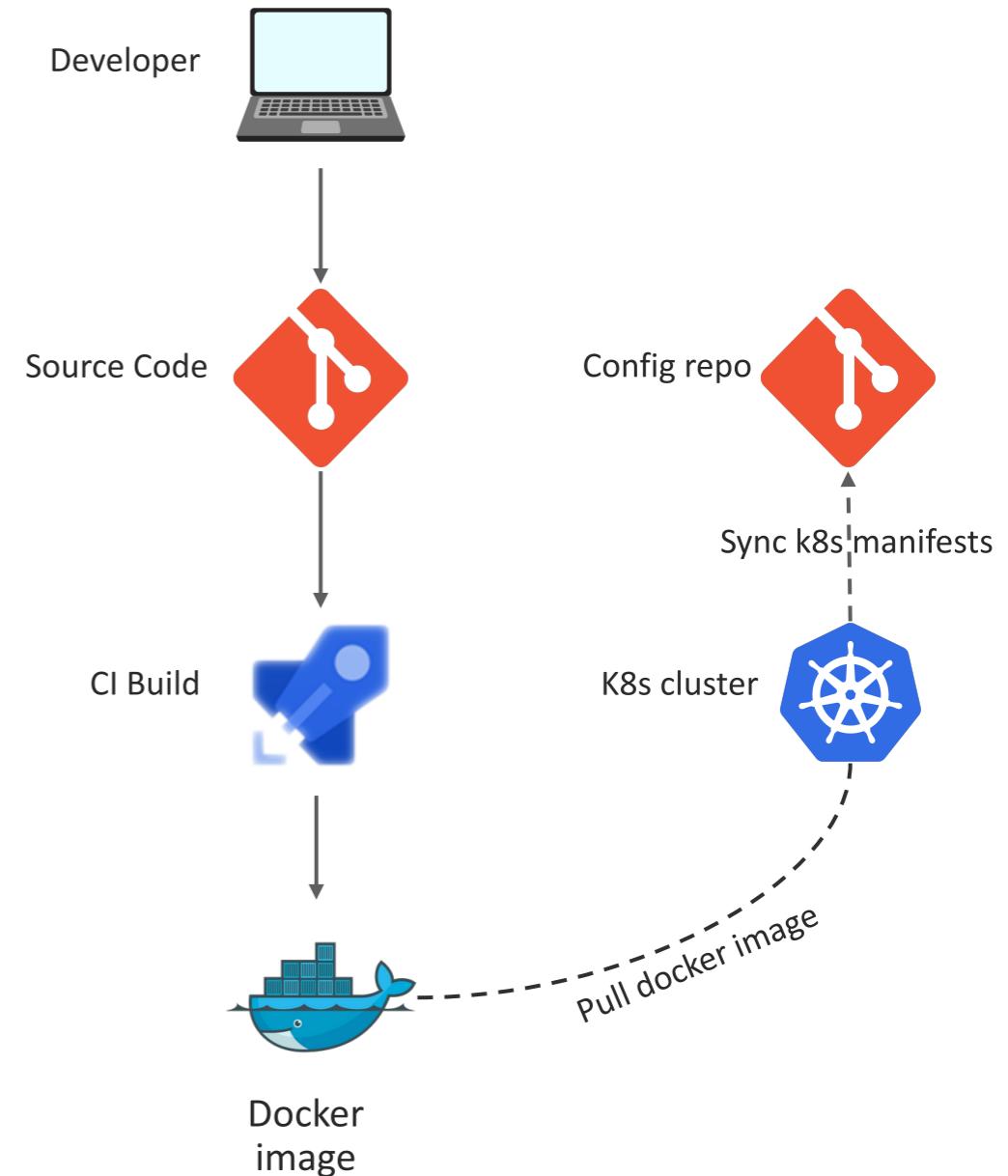
Samiya Akhtar  
Software Engineer at  
**Microsoft**



# GitOps



- Git is the single source of truth
- All k8s configuration in a git repository
- Cluster syncs to a k8s manifest git repository

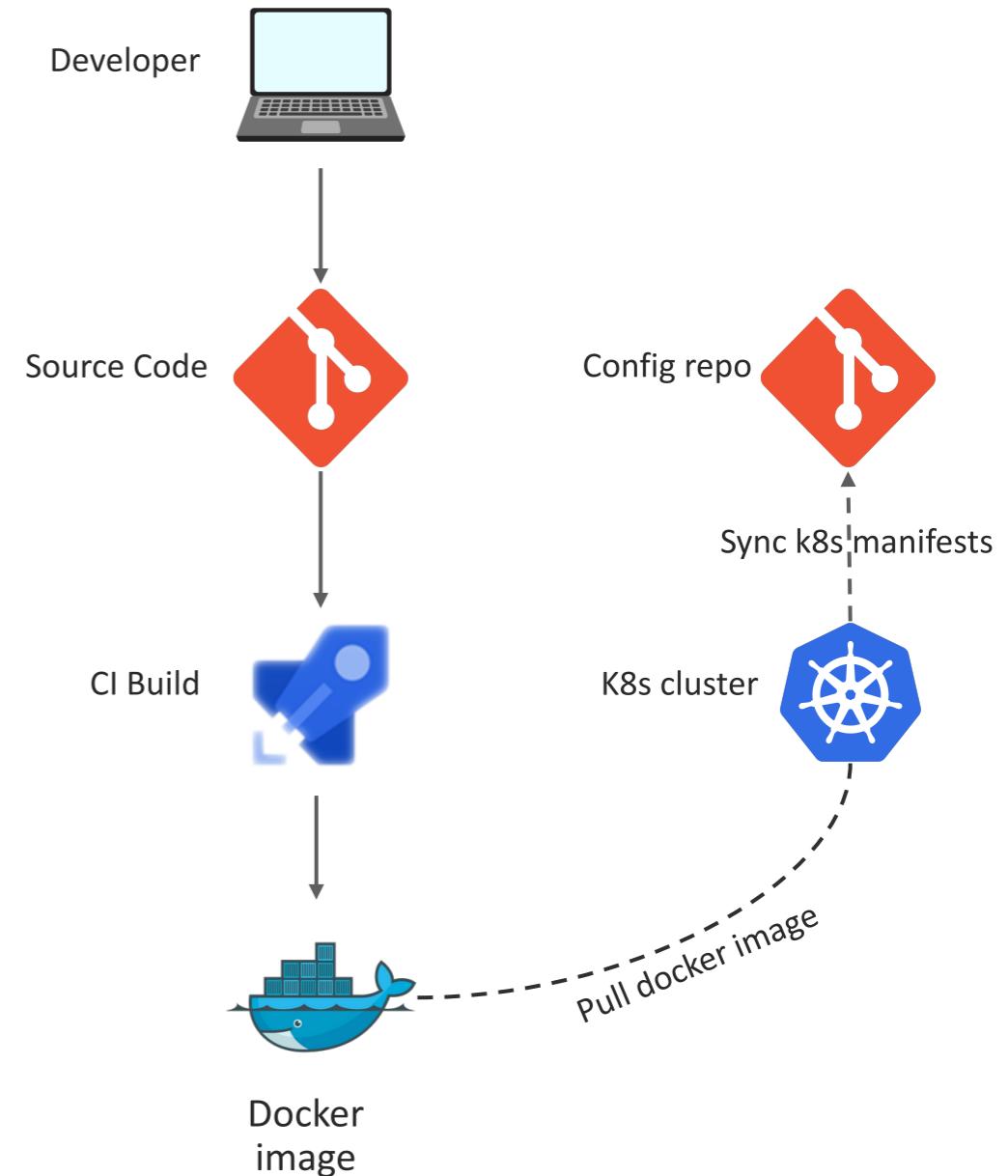




# Why GitOps



- Simplicity
- Easy mental model
- Declarative, like Kubernetes
- Secure
- Easy to monitor – tracking via git history





# GitOps Observability

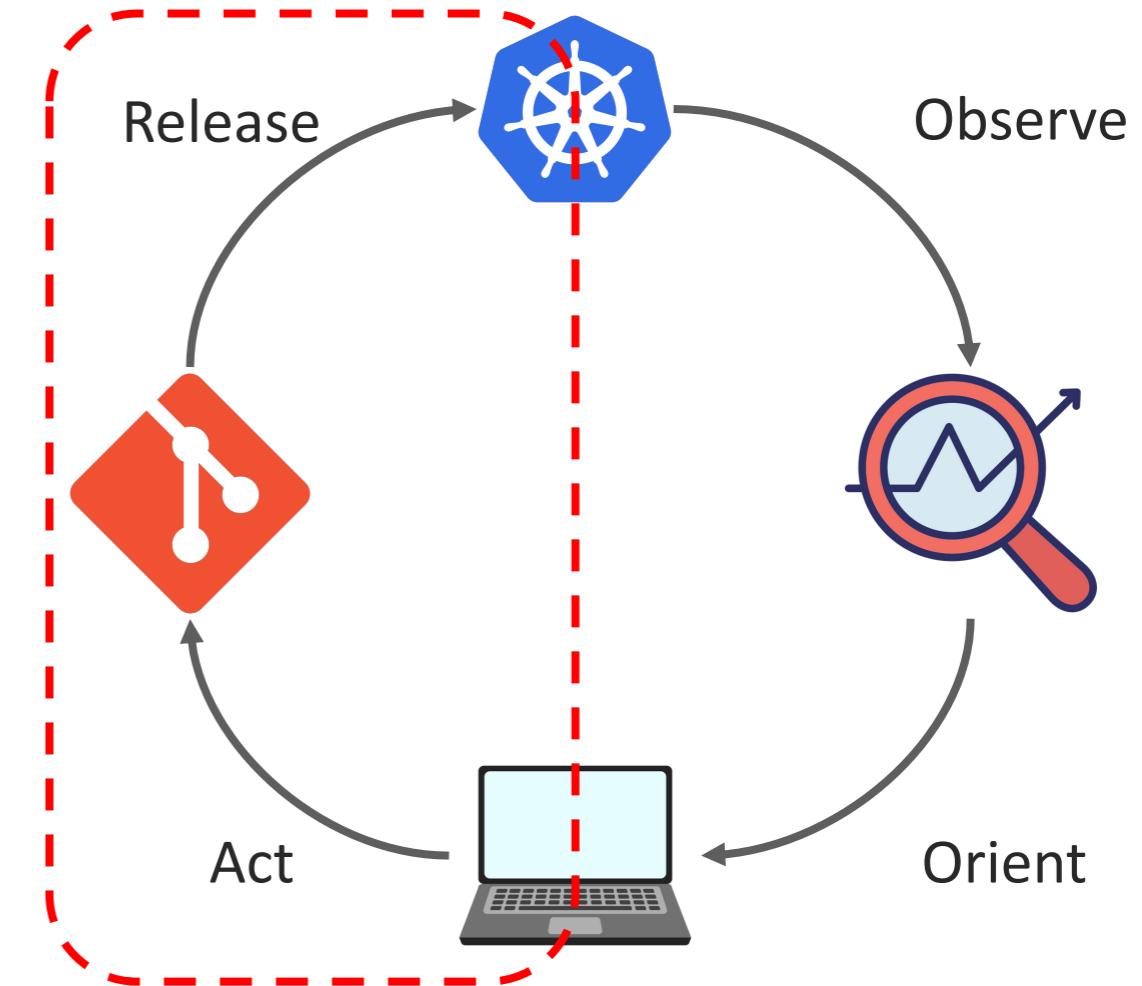
“...in GitOps, we MUST use continuous observation and verification, to enable app & cluster management.”

*– Alexis Richardson (CEO of Weaveworks)*



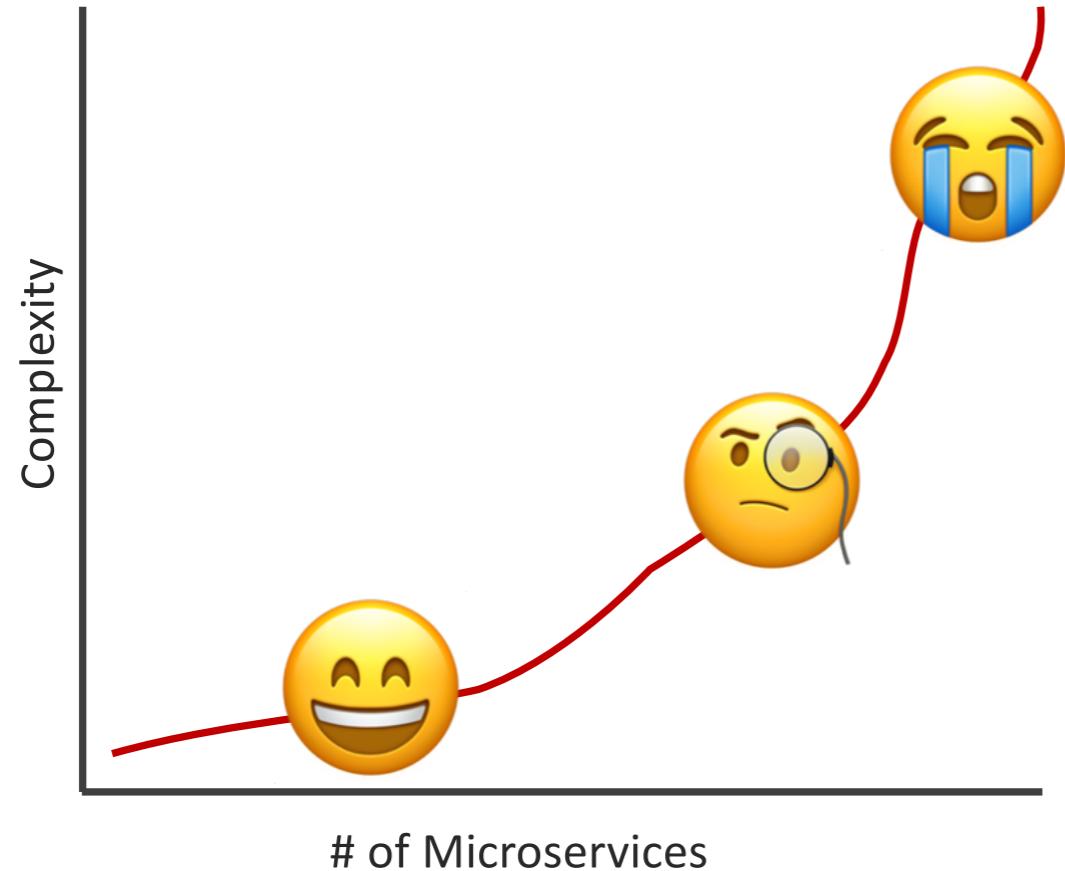
# GitOps Observability

- Focused on the deciding, acting, and releasing.





# GitOps Challenges



## What is complexity?

- Organizational complexity – many teams
- Flighting features
- Cost optimization of k8s clusters
- Inconsistent feedback cycles

# How it might work





# Scales from single team to organizations

**Fabrikam Trivia** team wants to improve the Trivia App to get users to play Trivia for a longer duration of time by integrating work from other sub teams

**Developer:**

*Dani*

**Product Owner:**

*Paul*

**Operations:**

*Oliver*



## Fabrikam Trivia

How many kilobytes in one gigabyte (in decimal)?

- 1024
- 1000000
- 1000
- 1048576

**Submit**

.at is the top-level domain for what country?

- Austria
- Argentina
- Australia
- Angola

**Submit**

The acronym "RIP" stands for which of these?

- Routing Information Protocol
- Runtime Instance Processes
- Regular Interval Processes
- Routine Inspection Protocol

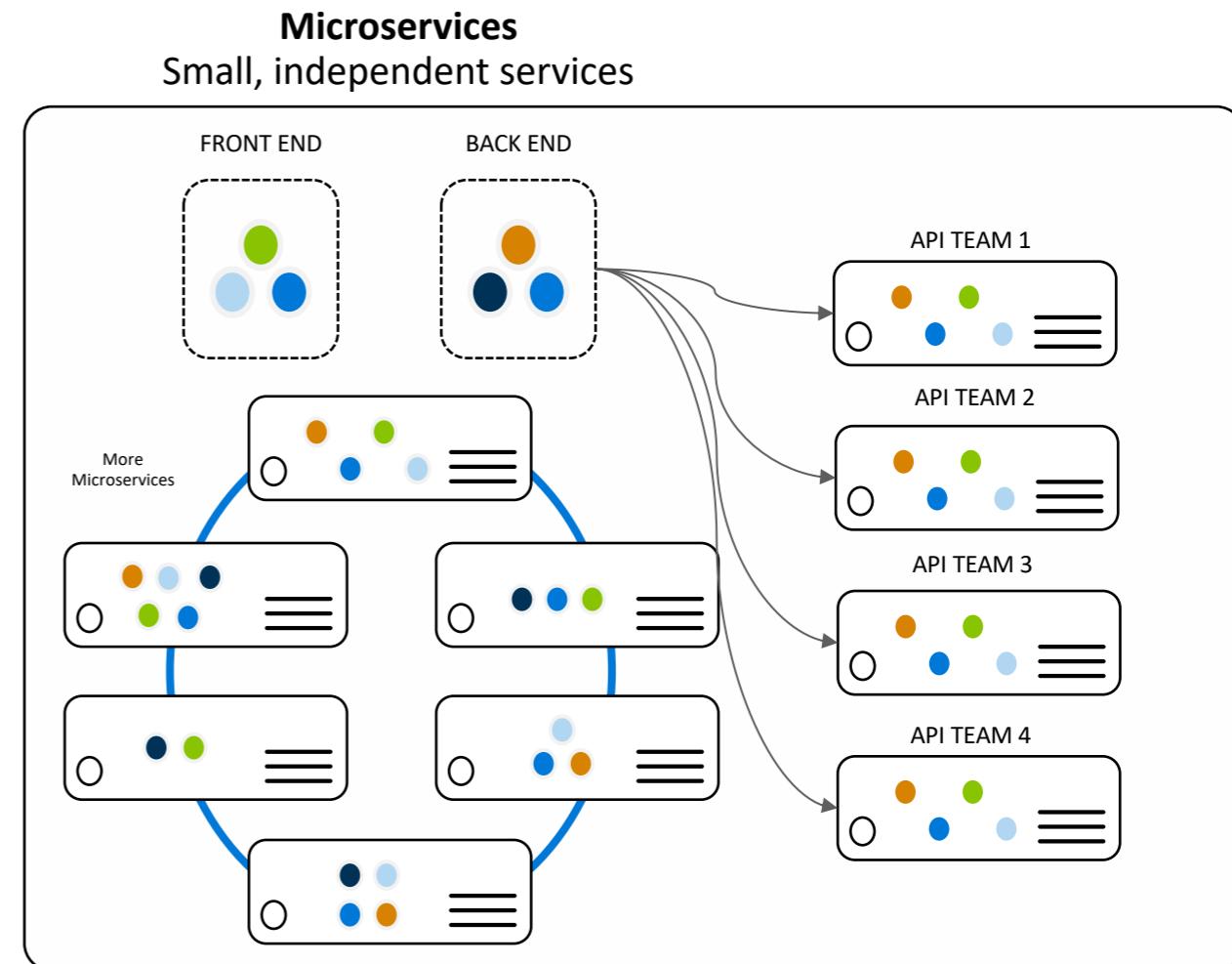
**Submit**

**Refresh Questions!**



# Scales from single team to organizations

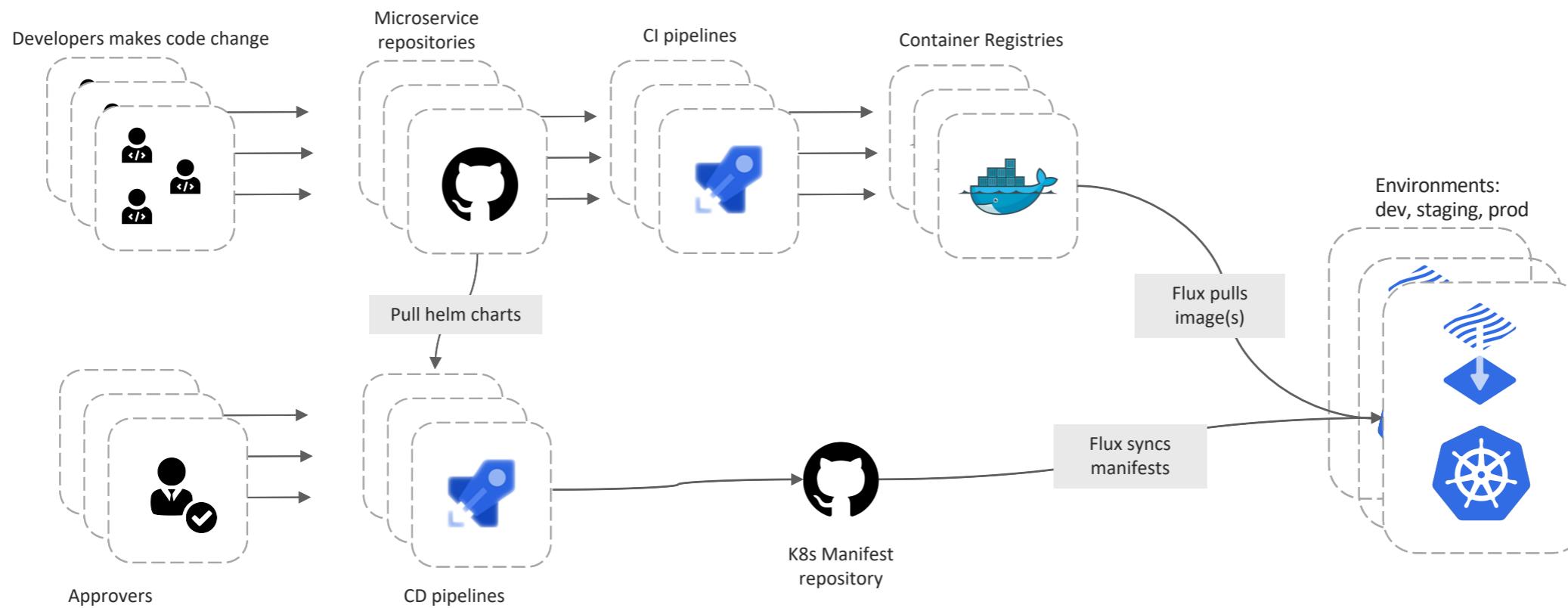
The **Fabrikam Trivia** team has a monolith application they wrote and would like to modernize their setup to include the deployment of microservices with Kubernetes.





# Scales from single team to organizations

Fabrikam Trivia engineers learn about GitOps and would like to store helm charts for their environments in git repositories for the respective microservices, which they will generate in CI/CD pipelines and install a GitOps operator on the clusters to sync to this repository.





# Scales from single team to organizations

Dani and Oliver on the Fabrikam Trivia Team run into problems:

- Too many microservices, pipelines – difficult to track
- Difficulty versioning
- Tight coupling between microservices
- Lacking observability into the entire process

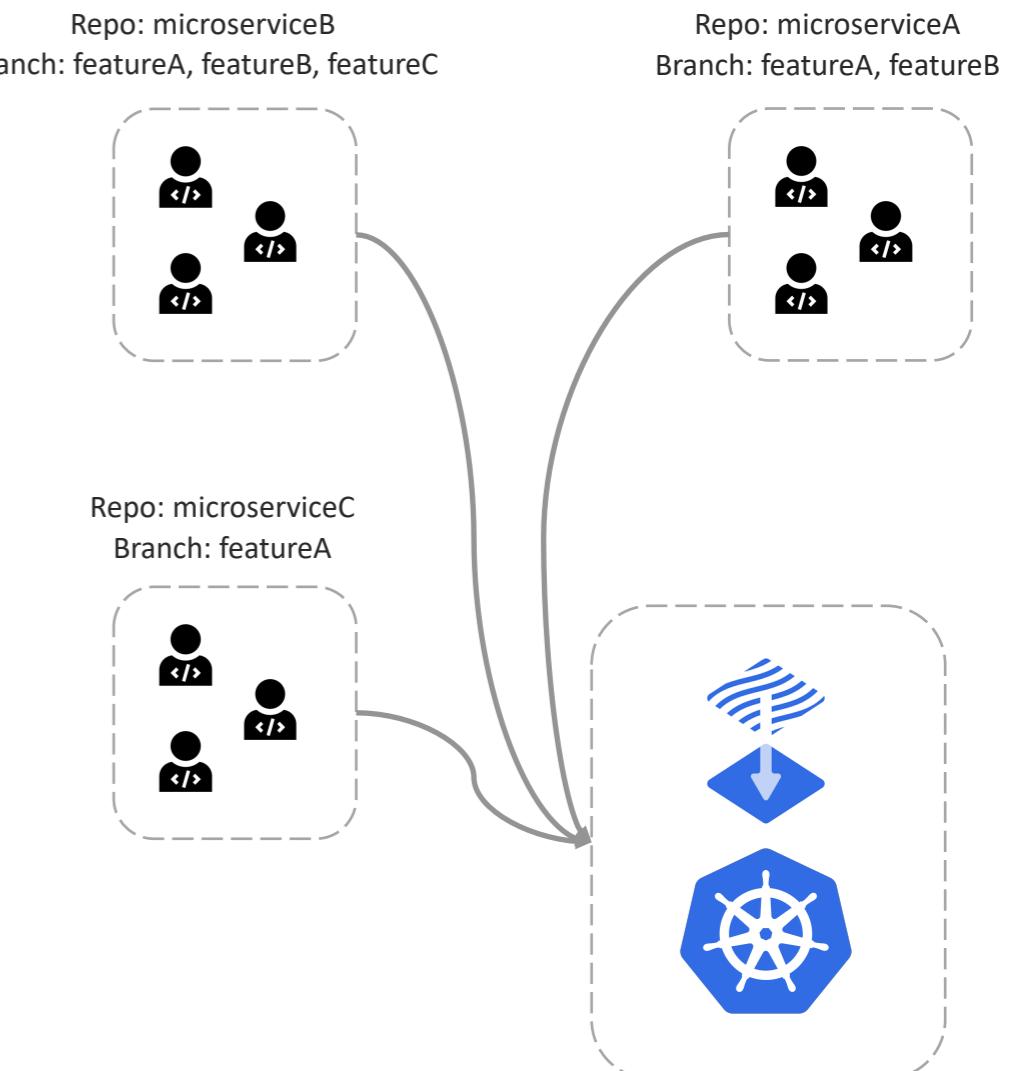




# Support many deployment strategies

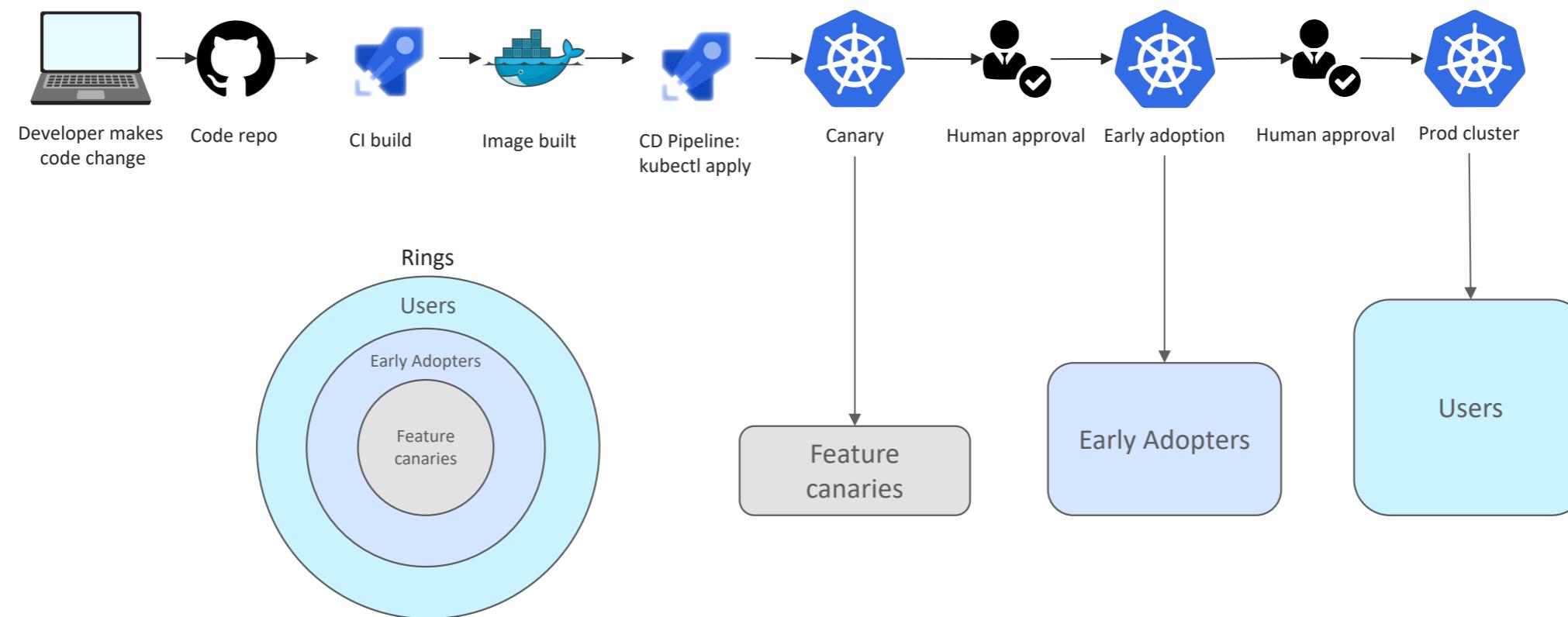
Fabrikam Trivia engineers want to test features in a single cluster to cut cost. They learn about the concept of deployment rings:

- Deploy multiple environments in a single cluster, using a service mesh
- Test in production





# Support many deployment strategies

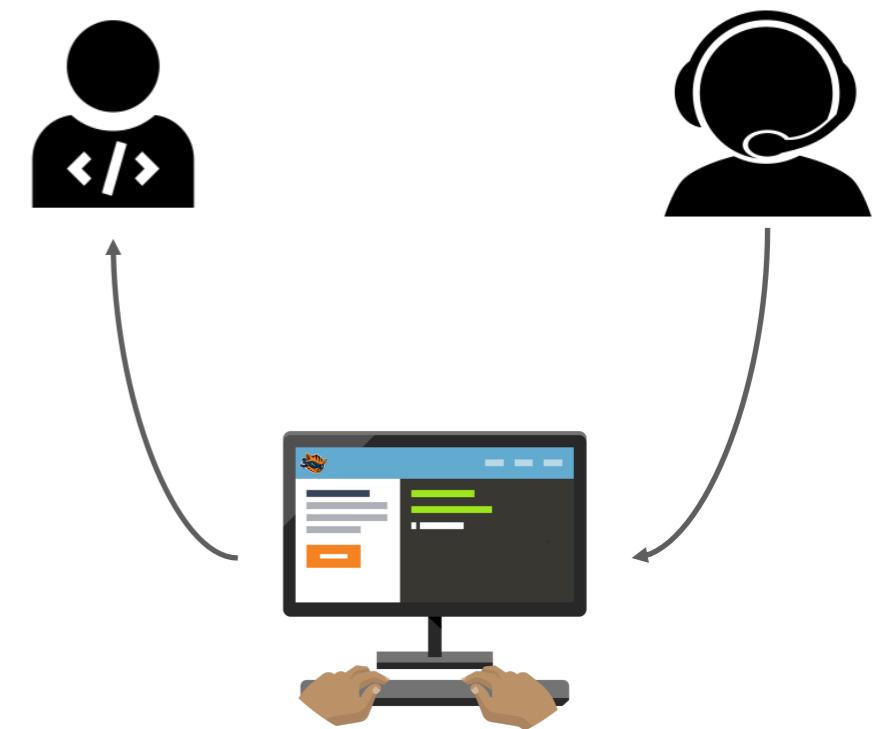




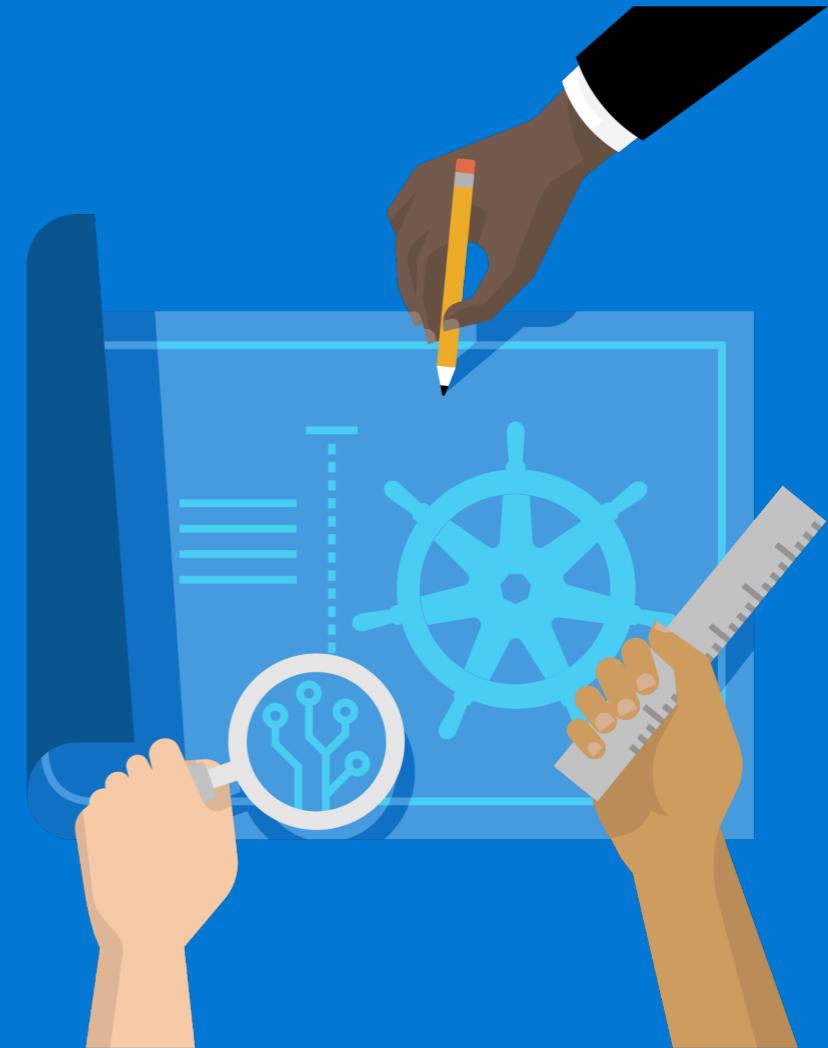
# Enables predictability in deployments

Oliver is on call and ***he receives a call at 3 AM***

- The production environment has a bug and Oliver needs help from the developer(s) to investigate
- Oliver wants to glance at a page quickly to find his developer contact
- Oliver wants to know approximately how long a deployment will take to go through

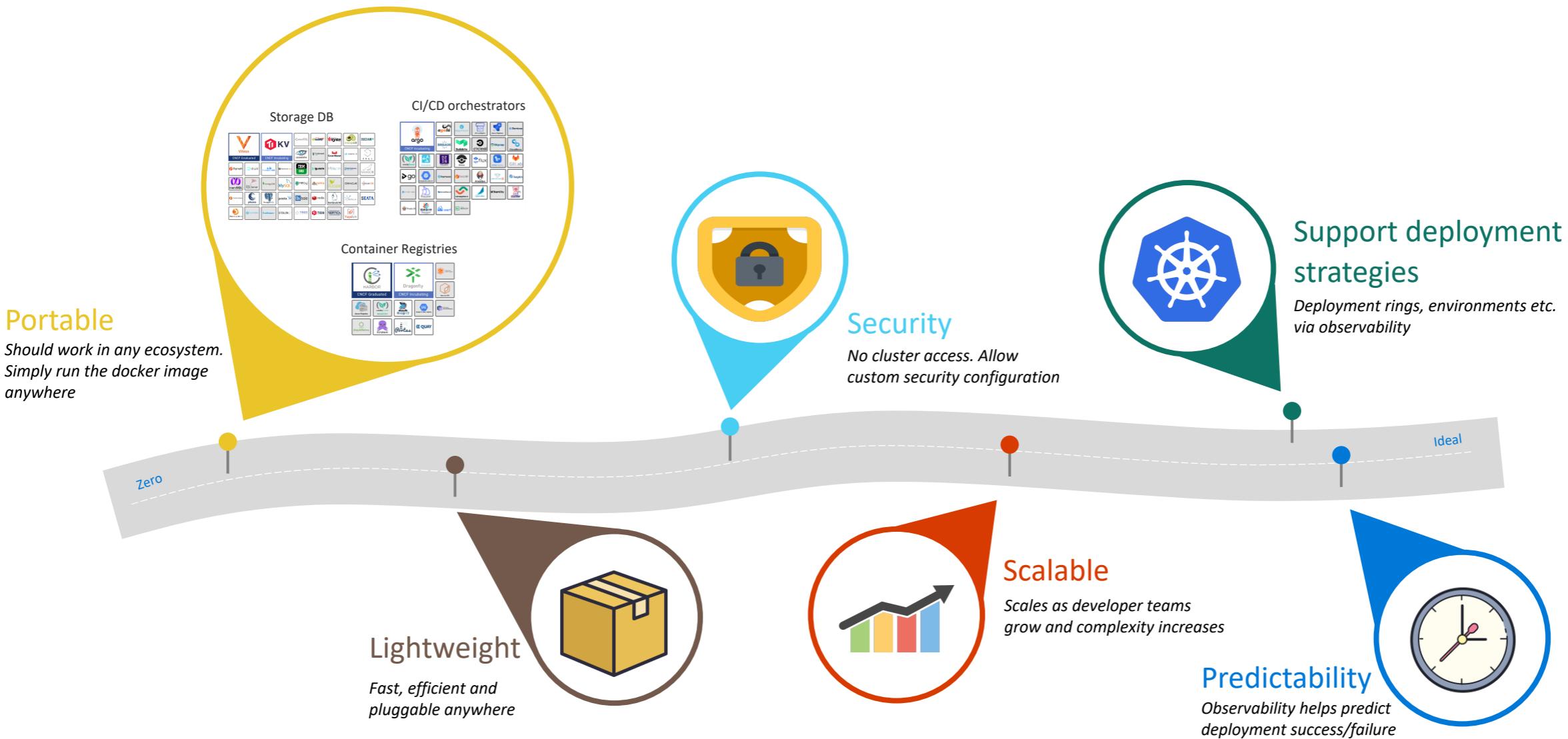


# The Ideal Solution

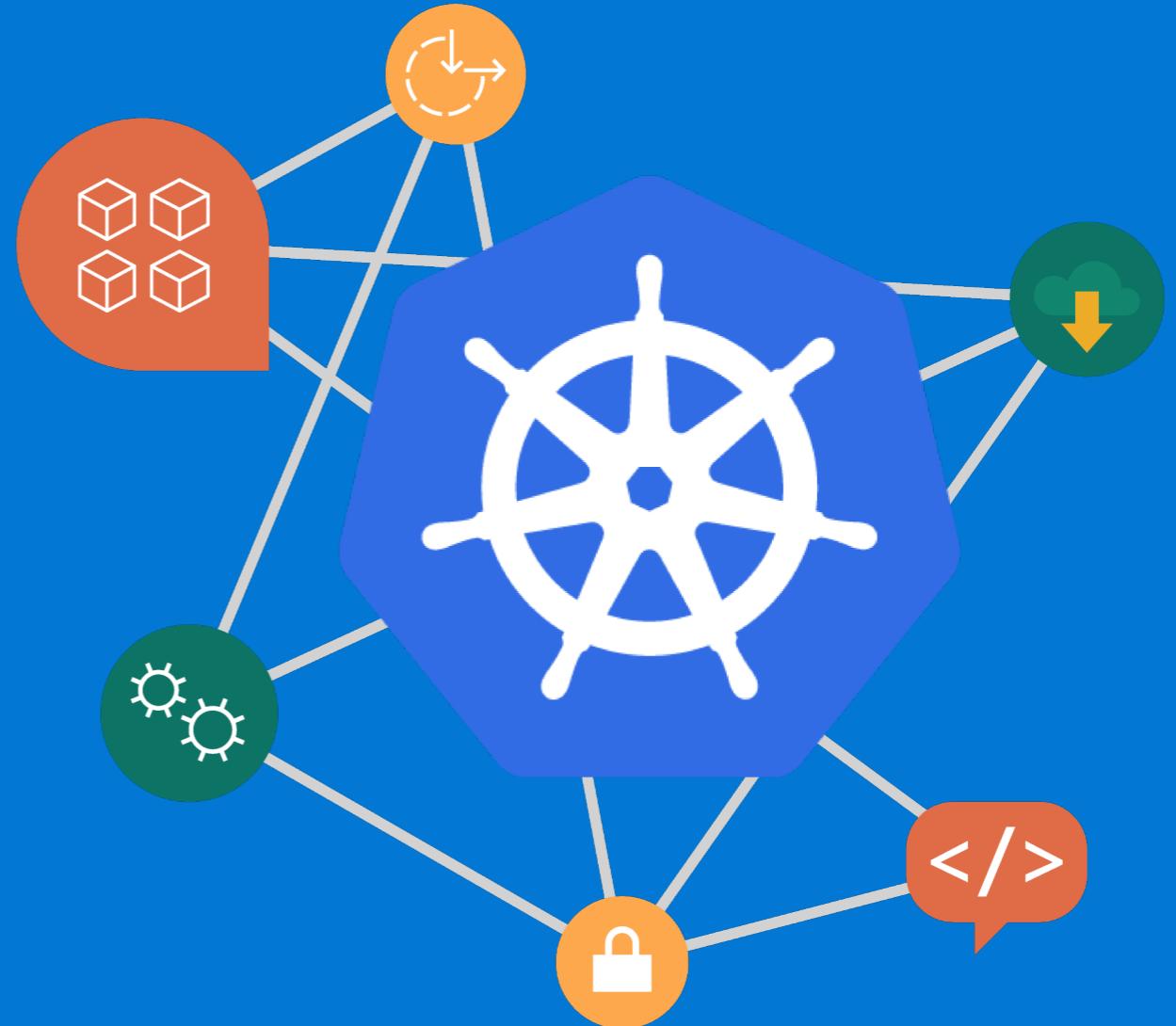




# Journey to Great GitOps Observability



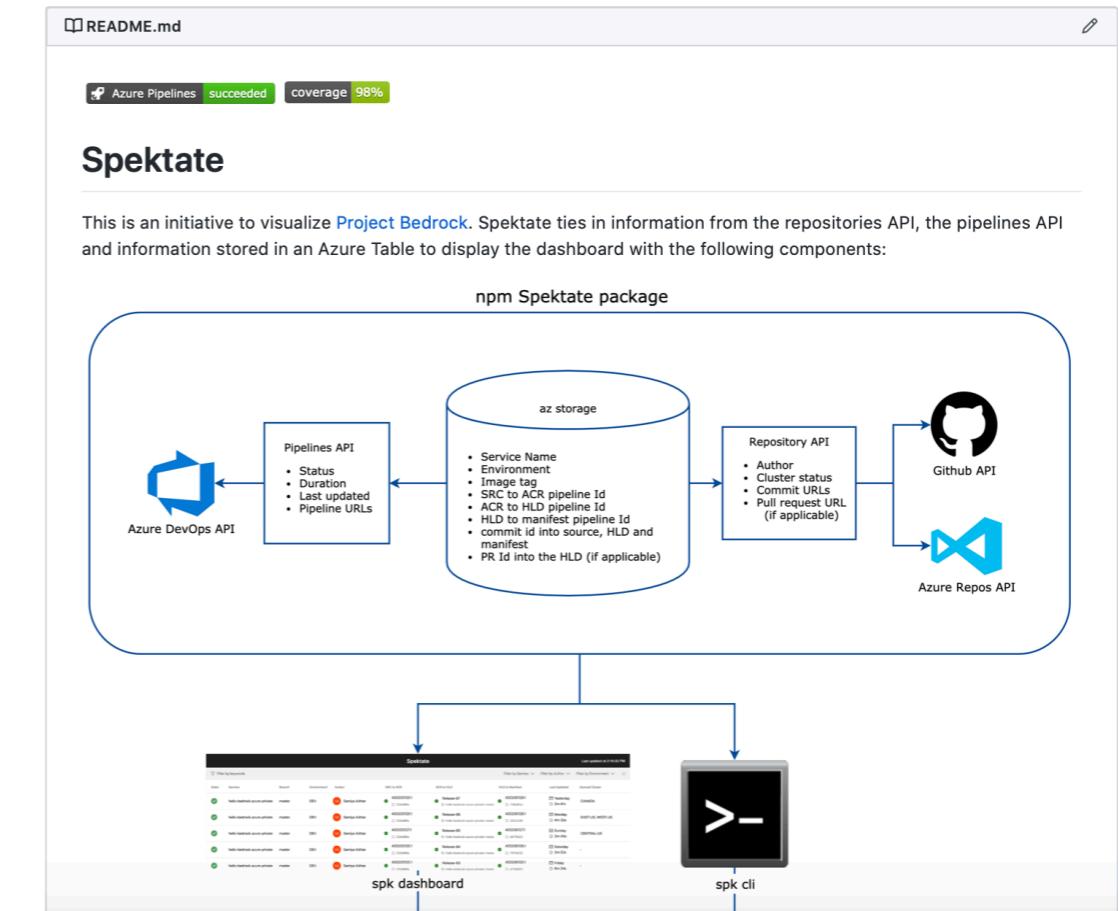
# How we could solve it





# Spektate

- GitOps visualization tool – a single page application to introspect all microservices
  - Application code changes
  - Author information
  - Deployment rings
  - PR to deploy to cluster and merging author
  - High level definition changes
  - Cluster sync statuses



<https://github.com/microsoft/spektate>



# Demo

Dani loads up the dashboard and glances at the recent activity that made its way to the cluster.

Spektate											Last updated at 5:45:05 PM			
Bedrock Deployments											Filter by Service	Filter by Author	Filter by Ring	X
State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster				
✓	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 hello-world-full-stack-frontend:master-2...	3514 DEPLOY/hello-world-full-stack-frontend...	SA Samiya Akhtar	20200724.4 28f5a4d	Just now 8m 17s	EAST-US				
✓	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 hello-world-full-stack-backend:dev-202...	3511 DEPLOY/hello-world-full-stack-backend...	SA Samiya Akhtar	20200724.2 e98d2ce	4m ago 6m 4s	-				
✓	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 hello-world-full-stack-backend:securityb...	3510 DEPLOY/hello-world-full-stack-backend...	SA Samiya Akhtar	20200724.3 b6aad5c	4m ago 6m 38s	-				
✓	frontend	DEV	Michael Tarn	20200724.3 beb7bb3	20200724.3 hello-world-full-stack-frontend:dev-2020...	3513 DEPLOY/hello-world-full-stack-frontend...	SA Samiya Akhtar	20200724.1 15bf4b3	4m ago 6m 45s	-				



# Demo

Yvonne, one of the developers, just merged a crucial API into the code repository.

**Spektate**

Last updated at 5:46:37 PM

State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster
<span>🟡</span>	backend	-	Yvonne Radsmikham	20200724.5 f769496					<span>Just now</span> <span>&lt;1s</span>	-
<span>🟢</span>	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	<span>20200724.4</span> <span>hello-world-full-stack-frontend:master-2...</span>	<span>3514</span> <span>DEPLOY/hello-world-full-stack-frontend...</span>	Samiya Akhtar	20200724.4 28f5a4d	<span>3m ago</span> <span>8m 17s</span>	EAST-US
<span>🟢</span>	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	<span>20200724.4</span> <span>hello-world-full-stack-backend:dev-202...</span>	<span>3511</span> <span>DEPLOY/hello-world-full-stack-backend...</span>	Samiya Akhtar	20200724.2 e98d2ce	<span>5m ago</span> <span>6m 4s</span>	-
<span>🟢</span>	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	<span>20200724.3</span> <span>hello-world-full-stack-backend:securityb...</span>	<span>3510</span> <span>DEPLOY/hello-world-full-stack-backend...</span>	Samiya Akhtar	20200724.3 b6aad5c	<span>5m ago</span> <span>6m 38s</span>	-
<span>🟢</span>	frontend	DEV	Michael Tarn	20200724.3 beb7bb3	<span>20200724.3</span> <span>hello-world-full-stack-frontend:dev-2020...</span>	<span>3513</span> <span>DEPLOY/hello-world-full-stack-frontend...</span>	Samiya Akhtar	20200724.1 15bf4b3	<span>6m ago</span> <span>6m 45s</span>	-



# Demo

The docker image was created and CI pipeline passed successfully

**Spektate** Last updated at 5:49:10 PM

State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster
<span>Success</span>	backend	DEV	Yvonne Radsmikham	20200724.5 f769496			-	-	Just now 2m 6s	-
<span>Success</span>	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 74e9fcf	3514 DEPLOY/hello-world-full-stack-frontend:master-2...	Samiya Akhtar	20200724.4 28f5a4d	5m ago 8m 17s	EAST-US
<span>Success</span>	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 c7b11fd	3511 DEPLOY/hello-world-full-stack-backend:dev-202...	Samiya Akhtar	20200724.2 e98d2ce	8m ago 6m 4s	-
<span>Success</span>	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 ff84a52	3510 DEPLOY/hello-world-full-stack-backend:securityb...	Samiya Akhtar	20200724.3 b6aad5c	8m ago 6m 38s	-
<span>Success</span>	frontend	DEV	Michael Targ	20200724.3 beb7bb3	20200724.3 beb7bb3	3513 DEPLOY/hello-world-full-stack-frontend:dev-2020...	Samiya Akhtar	20200724.1 15bf4b3	8m ago 6m 45s	-



# Demo

Metadata was updated for this docker image in the config for the DEV ring

**Spektate** Last updated at 5:49:40 PM

Filter by keywords Bedrock Deployments Filter by Service Filter by Author Filter by Ring X

State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster
<span>Y</span>	backend	DEV	Yvonne Radsmikham	20200724.5 f769496	20200724.5 hello-world-full-stack-backend:dev-202...	-	-	-	2m ago 2m 6s	-
<span>✓</span>	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 hello-world-full-stack-frontend:master-2...	3514 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	✓ 20200724.4 28f5a4d	6m ago 8m 17s	EAST-US
<span>✓</span>	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 hello-world-full-stack-backend:dev-202...	3511 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	✓ 20200724.2 e98d2ce	8m ago 6m 4s	-
<span>✓</span>	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 hello-world-full-stack-backend:securityb...	3510 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	✓ 20200724.3 b6aad5c	8m ago 6m 38s	-
<span>✓</span>	frontend	DEV	Michael Targn	20200724.3 beb7bb3	20200724.3 hello-world-full-stack-frontend:dev-2020...	3513 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	✓ 20200724.1 15bf4b3	9m ago 6m 45s	-



# Demo

Metadata was updated for this docker image in the config for the DEV ring by opening a pull request into the DEV branch

Spektate											Last updated at 5:50:04 PM			
Bedrock Deployments											Filter by Service	Filter by Author	Filter by Ring	X
State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster				
blue circle	backend	DEV	Yvonne Radsmikham	20200724.5 f769496	20200724.5 hello-world-full-stack-backend:dev-202...	3515 DEPLOY/hello-world-full-stack-backend...	-	-	2m ago 2m 6s	-				
green checkmark	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 hello-world-full-stack-frontend:master-2...	3514 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.4 28f5a4d	6m ago 8m 17s	EAST-US				
green checkmark	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 hello-world-full-stack-backend:dev-202...	3511 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.2 e98d2ce	9m ago 6m 4s	-				
green checkmark	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 hello-world-full-stack-backend:securityb...	3510 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.3 b6aad5c	9m ago 6m 38s	-				
green checkmark	frontend	DEV	Michael Tarn	20200724.3 beb7bb3	20200724.3 hello-world-full-stack-frontend:dev-2020...	3513 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.1 15bf4b3	9m ago 6m 45s	-				



# Demo

The Metadata update PR was approved to merge Yvonne's changes into the DEV ring

**Spektate** Last updated at 5:52:06 PM

Filter by keywords Bedrock Deployments Filter by Service Filter by Author Filter by Ring X

State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster
!	backend	DEV	Yvonne Radsmikhram	20200724.5 f769496	20200724.5 hello-world-full-stack-backend:dev-202...	3515 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	-	4m ago 2m 6s	-
✓	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 hello-world-full-stack-frontend:master-2...	3514 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.4 28f5a4d	8m ago 8m 17s	EAST-US
✓	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 hello-world-full-stack-backend:dev-202...	3511 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.2 e98d2ce	11m ago 6m 4s	-
✓	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 hello-world-full-stack-backend:securityb...	3510 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.3 b6aad5c	11m ago 6m 38s	-
✓	frontend	DEV	Michael Tarn	20200724.3 beb7bb3	20200724.3 hello-world-full-stack-frontend:dev-2020...	3513 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.1 15bf4b3	11m ago 6m 45s	-



# Demo

The merge triggered generation of K8s manifests to be updated with the new docker image

**Spektate** Last updated at 5:52:36 PM

Filter by keywords Bedrock Deployments Filter by Service Filter by Author Filter by Ring X

State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster
<span>🕒</span>	backend	DEV	Yvonne Radsmikhram	20200724.5 f769496	20200724.5 hello-world-full-stack-backend:dev-202...	3515 DEPLOY/hello-world-full-stack-backend...	<span>SA</span> Samiya Akhtar	20200724.5 76fc388	Just now 6m 25s	-
<span>✓</span>	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 hello-world-full-stack-frontend:master-2...	3514 DEPLOY/hello-world-full-stack-frontend...	<span>SA</span> Samiya Akhtar	20200724.4 28f5a4d	9m ago 8m 17s	EAST-US
<span>✓</span>	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 hello-world-full-stack-backend:dev-202...	3511 DEPLOY/hello-world-full-stack-backend...	<span>SA</span> Samiya Akhtar	20200724.2 e98d2ce	11m ago 6m 4s	-
<span>✓</span>	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 hello-world-full-stack-backend:securityb...	3510 DEPLOY/hello-world-full-stack-backend...	<span>SA</span> Samiya Akhtar	20200724.3 b6aad5c	11m ago 6m 38s	-
<span>✓</span>	frontend	DEV	Michael Tarn	20200724.3 beb7bb3	20200724.3 hello-world-full-stack-frontend:dev-2020...	3513 DEPLOY/hello-world-full-stack-frontend...	<span>SA</span> Samiya Akhtar	20200724.1 15bf4b3	12m ago 6m 45s	-



# Demo

K8s manifests are pushed into the repo being watched by a syncing agent such as Flux

Spektate											Last updated at 5:53:58 PM			
Bedrock Deployments											Filter by Service	Filter by Author	Filter by Ring	X
State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster				
✓	backend	DEV	Yvonne Radsmikharn	20200724.5 f769496	20200724.5 hello-world-full-stack-backend:dev-202...	3515 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.5 76fc388	Just now 7m 28s	-				
✓	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 hello-world-full-stack-frontend:master-2...	3514 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.4 28f5a4d	10m ago 8m 17s	EAST-US				
✓	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 hello-world-full-stack-backend:dev-202...	3511 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.2 e98d2ce	13m ago 6m 4s	-				
✓	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 hello-world-full-stack-backend:securityb...	3510 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.3 b6aad5c	13m ago 6m 38s	-				
✓	frontend	DEV	Michael Targ	20200724.3 beb7bb3	20200724.3 hello-world-full-stack-frontend:dev-2020...	3513 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.1 15bf4b3	13m ago 6m 45s	-				



# Demo

Flux synced the latest changes to the EAST-US cluster

**Spektate** Last updated at 5:54:37 PM

Filter by keywords Bedrock Deployments Filter by Service Filter by Author Filter by Ring X

State	Service	Ring	Author	Image Creation	Metadata Update	Approval Pull Request	Merged By	Ready to Deploy	Last Updated	Synced Cluster
✓	backend	DEV	Yvonne Radsmikham	20200724.5 f769496	20200724.5 hello-world-full-stack-backend:dev-202...	3515 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.5 76fc388	Just now 7m 28s	EAST-US
✓	frontend	MASTER	Samiya Akhtar	20200724.4 74e9fcf	20200724.4 hello-world-full-stack-frontend:master-2...	3514 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.4 28f5a4d	11m ago 8m 17s	-
✓	backend	DEV	Edaena Salinas Jasso	20200724.4 c7b11fd	20200724.4 hello-world-full-stack-backend:dev-202...	3511 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.2 e98d2ce	13m ago 6m 4s	-
✓	backend	SECURITYBUGFIX	Samiya Akhtar	20200724.3 ff84a52	20200724.3 hello-world-full-stack-backend:securityb...	3510 DEPLOY/hello-world-full-stack-backend...	Samiya Akhtar	20200724.3 b6aad5c	13m ago 6m 38s	-
✓	frontend	DEV	Michael Targ	20200724.3 beb7bb3	20200724.3 hello-world-full-stack-frontend:dev-2020...	3513 DEPLOY/hello-world-full-stack-frontend...	Samiya Akhtar	20200724.1 15bf4b3	14m ago 6m 45s	-



# Demo

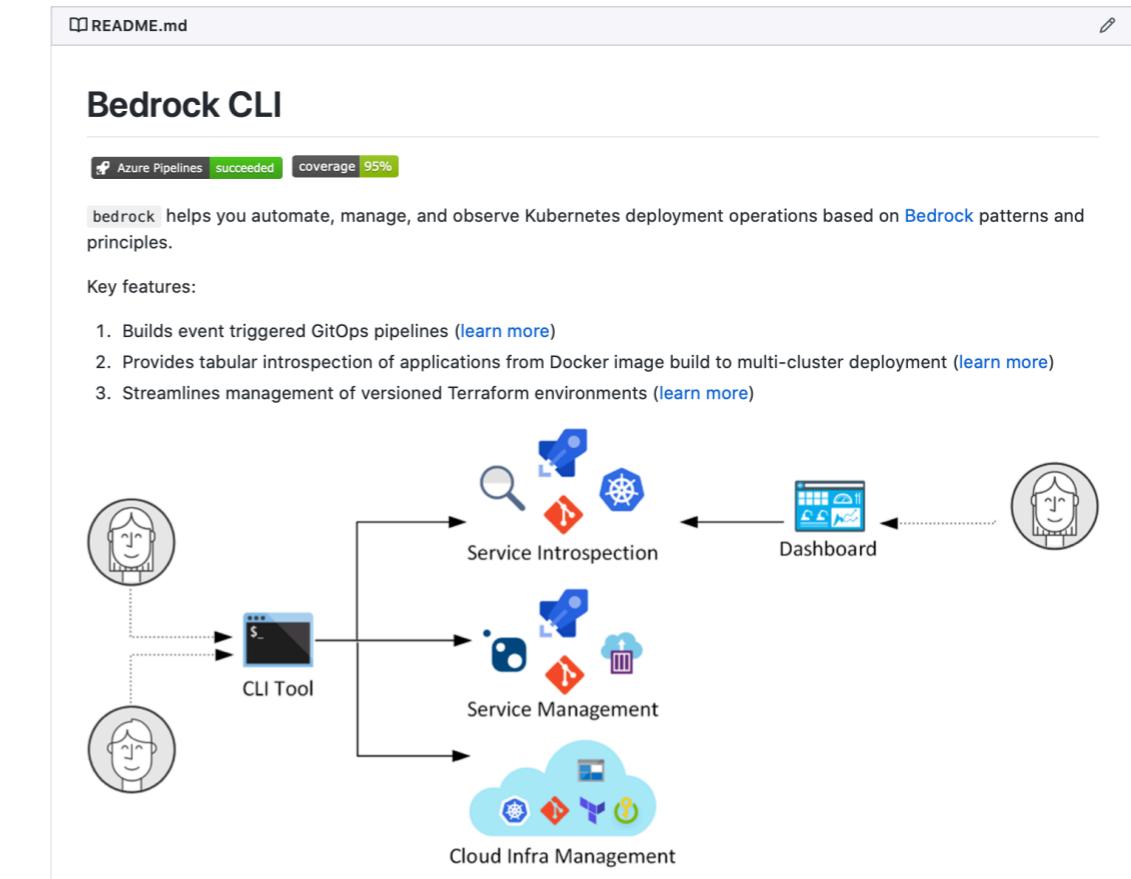
1. The backend pods are updated in the cluster.
2. Dani, can now head over to the DEV cluster and verify that the new API works.

```
~ -  
└─ kubectl get pods  
NAME                      READY   STATUS    RESTARTS   AGE  
backend-dev-858656c5c8-tb9rh   1/1     Running   0          2m29s  
backend-master-5d5cd8865-mtt6d   1/1     Running   0          20h  
backend-securitybugfix-7bc84d5468-btjng   1/1     Running   0          11m  
frontend-dev-88f5d9d6c-c8zc8      1/1     Running   0          14m  
frontend-master-84b765469c-9nj7x     1/1     Running   0          11m  
frontend-securitybugfix-6b48c69d79-jjh5     1/1     Running   0          19h  
traefik2-6bbcbcf7c-l8nq5        1/1     Running   0          50d
```



# Bedrock CLI

- Tooling to automate GitOps pipelines
- Sets up hooks for GitOps observability
- Easier configuration of Terraform multi-cluster K8s environments
- Built on engineering fundamentals



<https://github.com/microsoft/bedrock-cli>

<https://github.com/microsoft/bedrock>



# Bedrock Scenario

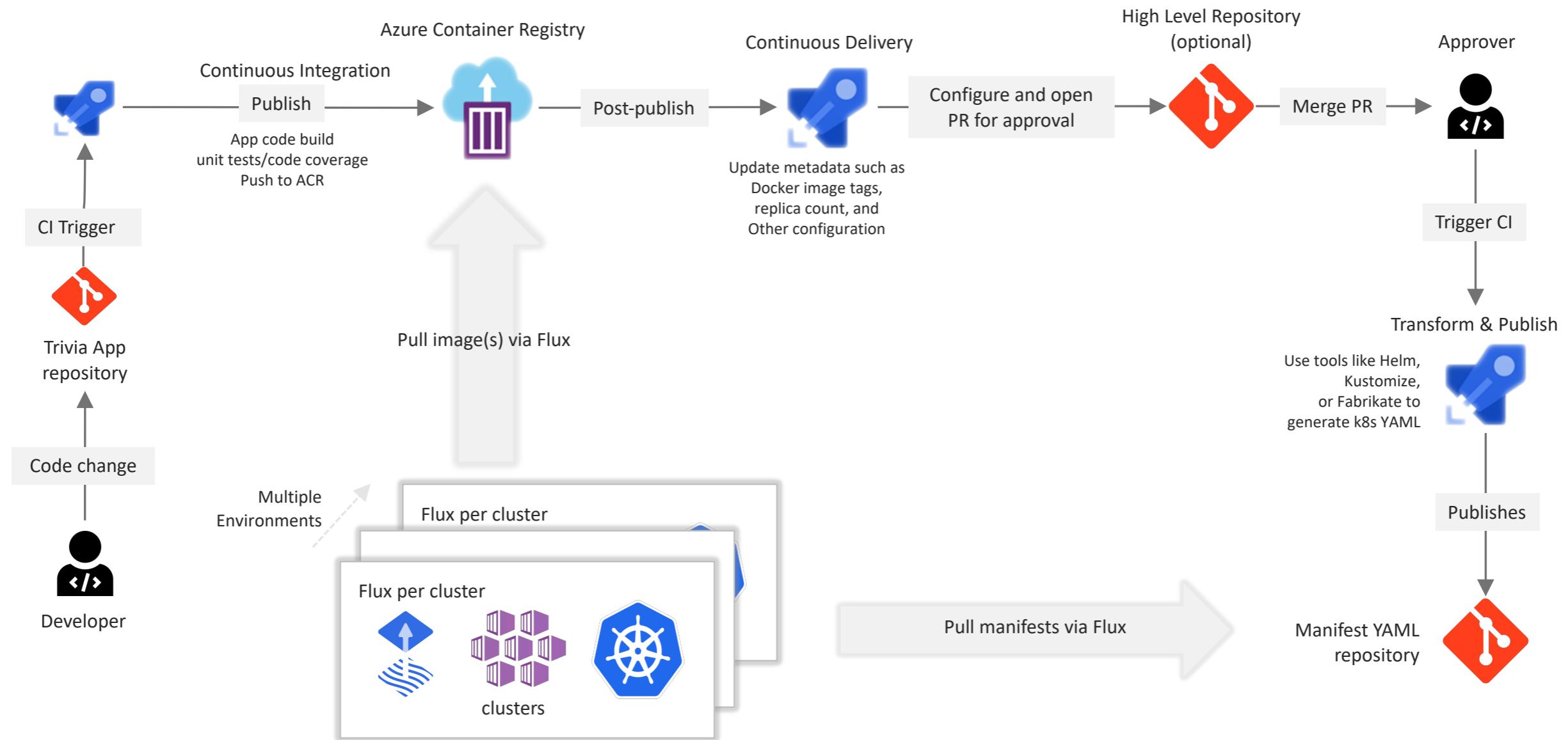
1. Dani downloads bedrock-cli and runs the commands to start using Spektate.
2. Dani is able to launch Spektate by running a single command

```
$ bedrock setup
info: az cli version 2.5.1
? Enter organization name
contoso
? Enter project name
fabrikam
? Enter your AzDO personal access token
*****
? Would you like to create a sample application repository? Yes
? Do you want to create a service principal? Yes
info: attempting to login to az command line
? Select one of the subscriptions
CSE Dev Crews Americas West
info: attempting to create service principal with az command line
info: Successfully created service principal with az command line
? Enter Azure Container Registry Name. The registry name must be unique within Azure
contosoacr
Create variable group
 Install manifest repo
 Install hld repo
 Install and verify manifest pipeline
? Enter storage account name
contosoazurestorage
 Update variable group
 Install helm repo
 Install sample app repo
 Install and verify lifecycle pipeline
 Install and verify build pipeline
```

```
$ bedrock deployment dashboard
info: Pulling dashboard docker image
info: Launching dashboard on http://localhost:4040
```



# Bedrock GitOps Flow





# Bedrock – DevOps For Kubernetes

Task	Without Bedrock	With Bedrock
Quickly setup a GitOps pipeline	Upskill on GitOps, Helm, and Kubernetes Provision an Azure DevOps instance and Azure subscription Follow manual instructions on Bedrock repo Manually check pipeline status through trial and error	Provision an Azure DevOps instance and Azure subscription <a href="#">bedrock setup</a> Check Azure DevOps or local git repos
Manage many Kubernetes microservices Yaml definitions	Hand edit yaml across many file <b>or</b> Manage several Helm value.yaml files and run Helm template several times. Especially true we wanting to pin to specific version of application (git commit/tag or Helm version) Prone to more errors	<a href="#">fab install</a> <a href="#">fab generate</a>
Observe microservice deployments from a pane of glass	Manually add telemetry to pipelines or wrote code to access Azure DevOps API Create a custom Azure DevOps dashboard Lacks easy visibility into the status of deployments to Kubernetes cluster(s)	<a href="#">bedrock init</a> Use Bedrock generated pipelines to build your microservices Make sure is running Docker locally <a href="#">bedrock deployment dashboard</a>



# Summary

- What is GitOps Observability?
- How to make GitOps more observable?
- Some ways that we addressed it

Thank you!  
Q & A





# Appendix

## GitOps Tooling:

- Bedrock - <https://github.com/microsoft/bedrock>
- Bedrock CLI - <https://github.com/microsoft/bedrock-cli>
- Fabrikate - <https://github.com/microsoft/fabrikate>
- Spektate - <https://github.com/microsoft/spektate>