KubeCon

CloudNativeCon

North America 2024

Bring Joy to your Deploy[ments]

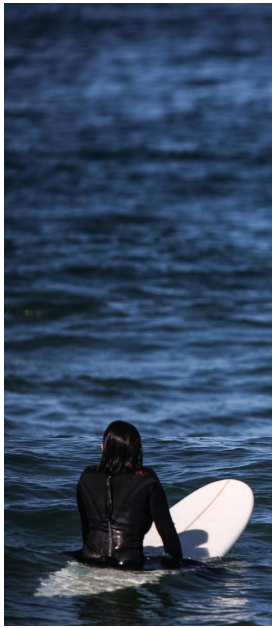
Murriel McCabe and Elizabeth Ponce

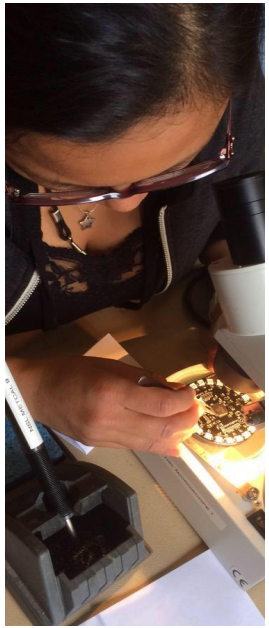
Elizabeth Ponce

```
apiVersion: kubecon/v24
kind: Bio
metadata:
  name: elizabeth
  labels:
    job: swe search infrastructure
    location: portland
    company: airbnb
spec:
  replicas: 3
    hobbies:
      - name: running
      - name: singing
      - name: community

      All opinions in this talk are mine!
```

Murriel Grace McCabe

opinions mine!





```
apiVersion: kubecon/v24
kind: Bio
metadata:
  name: murriel
  labels:
    job: cloud
    location: long beach
    company: google
spec:
  replicas: 4
    hobbies:
      - name: makingthings
      - name: gardening
      - name: community
      - name: goingoutside
---
apiVersion: russianblues.cat/v1
kind: Cat
metadata:
  name: orion
  ...
  name: andromeda
```

www.murrielgrace.com

Today's Focus

Deploying containerized applications to Kubernetes

Get Ready For 30 Minutes About:

- Fundamentals of CI/CD
- Overview of Open Source Tools
- Deployment Demo Environment
- How to choose which ones?

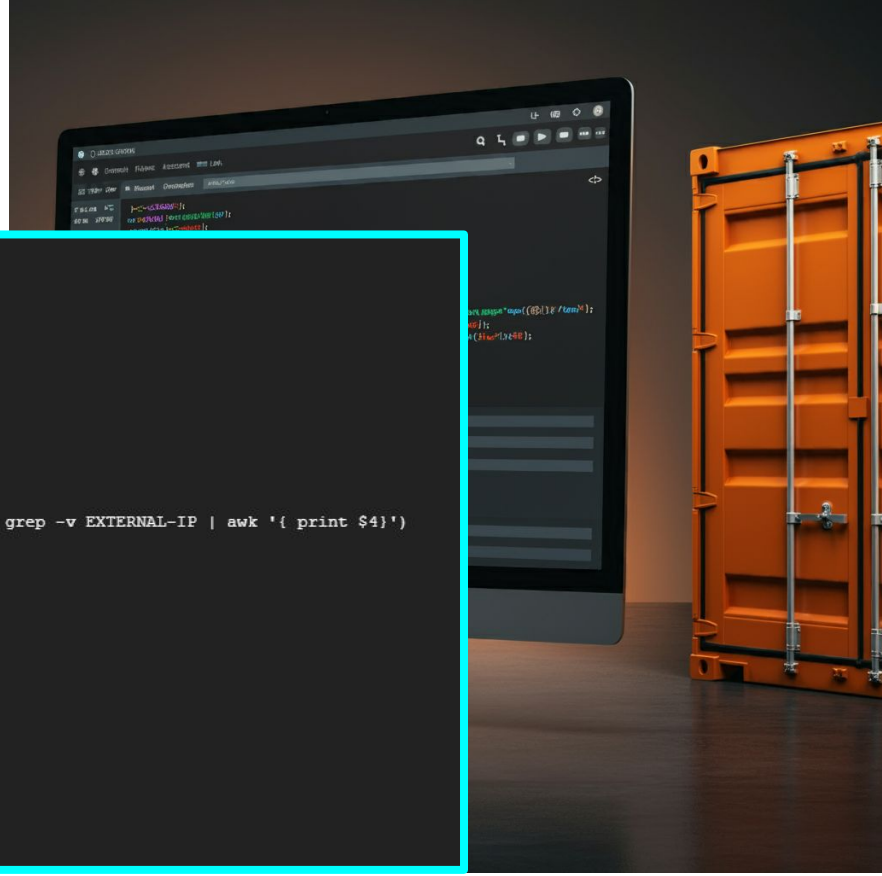
this is a

BEGINNER FRIENDLY

talk!

Demo App

whereami



```
murriel@cloudshell:~ (kubecon-2024)$ kubectl get all -n whereami
NAME                             READY   STATUS    RESTARTS   AGE
pod/whereami-b87457d5b-9k9x7     1/1     Running   0          101s
pod/whereami-b87457d5b-j69pw     1/1     Running   0          101s
pod/whereami-b87457d5b-ljszf     1/1     Running   0          101s

NAME               TYPE           CLUSTER-IP       EXTERNAL-IP    PORT(S)        AGE
service/whereami   LoadBalancer   34.118.236.197   34.83.204.27   80:31813/TCP   102s

NAME                         READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/whereami     3/3     3            3           102s

NAME                                   DESIRED   CURRENT   READY   AGE
replicaset.apps/whereami-b87457d5b     3         3         3       101s
murriel@cloudshell:~ (kubecon-2024)$ ENDPOINT=$(kubectl get svc whereami -n whereami | grep -v EXTERNAL-IP | awk '{ print $4}')
murriel@cloudshell:~ (kubecon-2024)$ curl $ENDPOINT
{
  "cluster_name": "demo-cluster",
  "gce_instance_id": "2429211004398225355",
  "gce_service_account": "kubecon-2024.svc.id.goog",
  "host_header": "34.83.204.27",
  "metadata": "frontend",
  "node_name": "gk3-demo-cluster-pool-2-c2571e4c-w6jp",
  "pod_ip": "10.119.128.5",
  "pod_name": "whereami-b87457d5b-j69pw",
  "pod_name_emoji": "\ud83e\udd7b",
  "pod_namespace": "whereami",
  "pod_service_account": "whereami",
  "project_id": "kubecon-2024",
  "timestamp": "2024-10-15T05:17:02",
  "zone": "us-west1-a"
}
```

https://github.com/deploywithjoy/kubecon24-demos

>> forked from https://github.com/GoogleCloudPlatform/kubernetes-engine-samples/tree/main/quickstarts/whereami

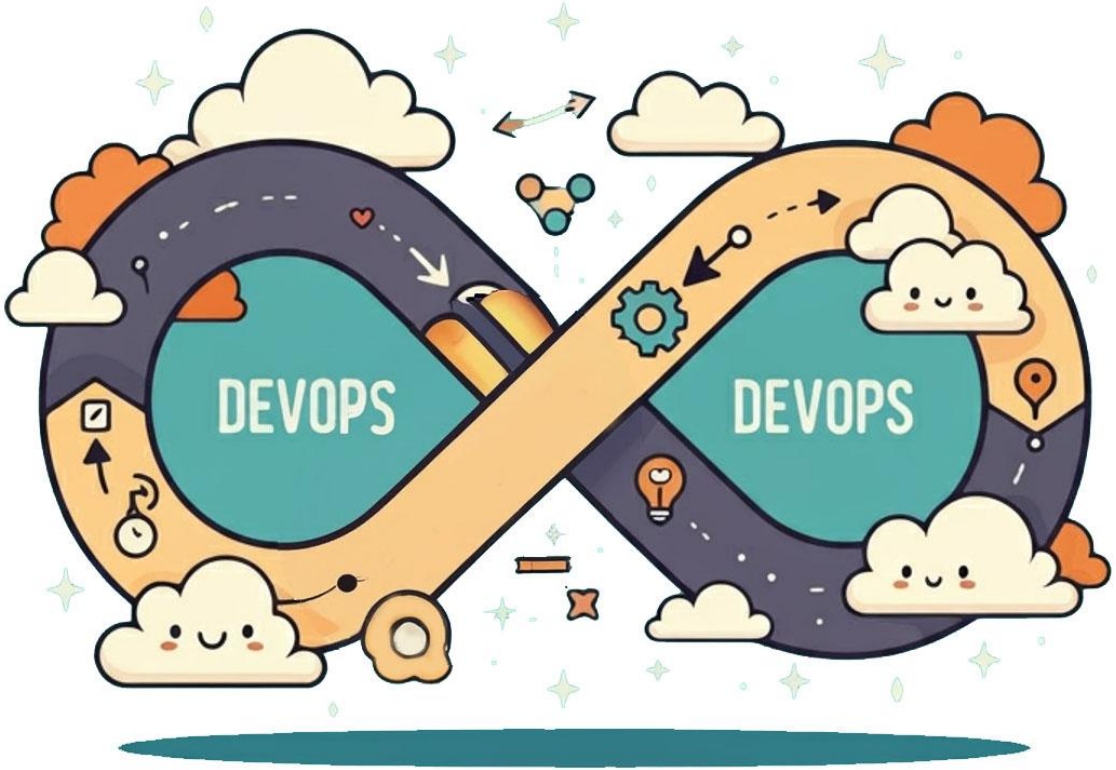
Inner Loop

Plan

Code

Build

Test



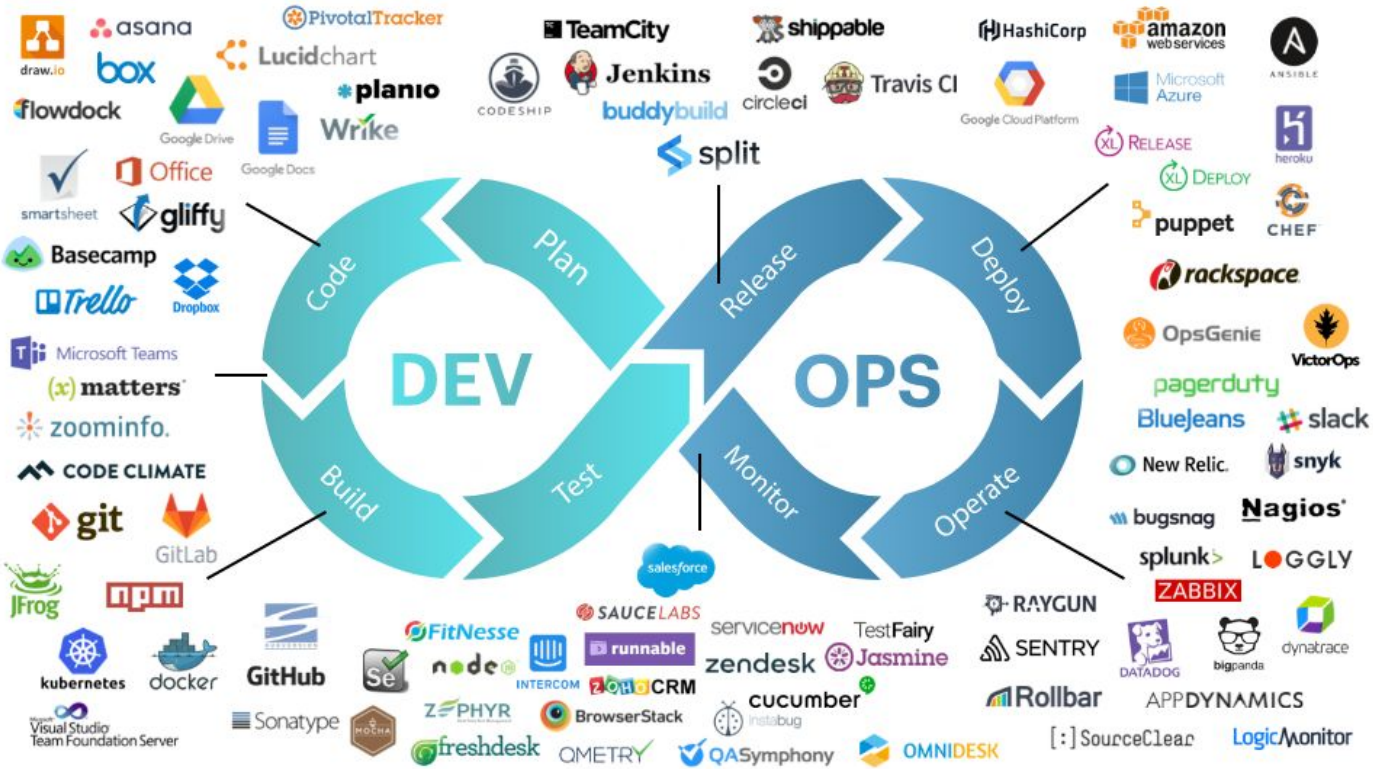
Outer Loop

Deploy

Release

Operate

Monitor

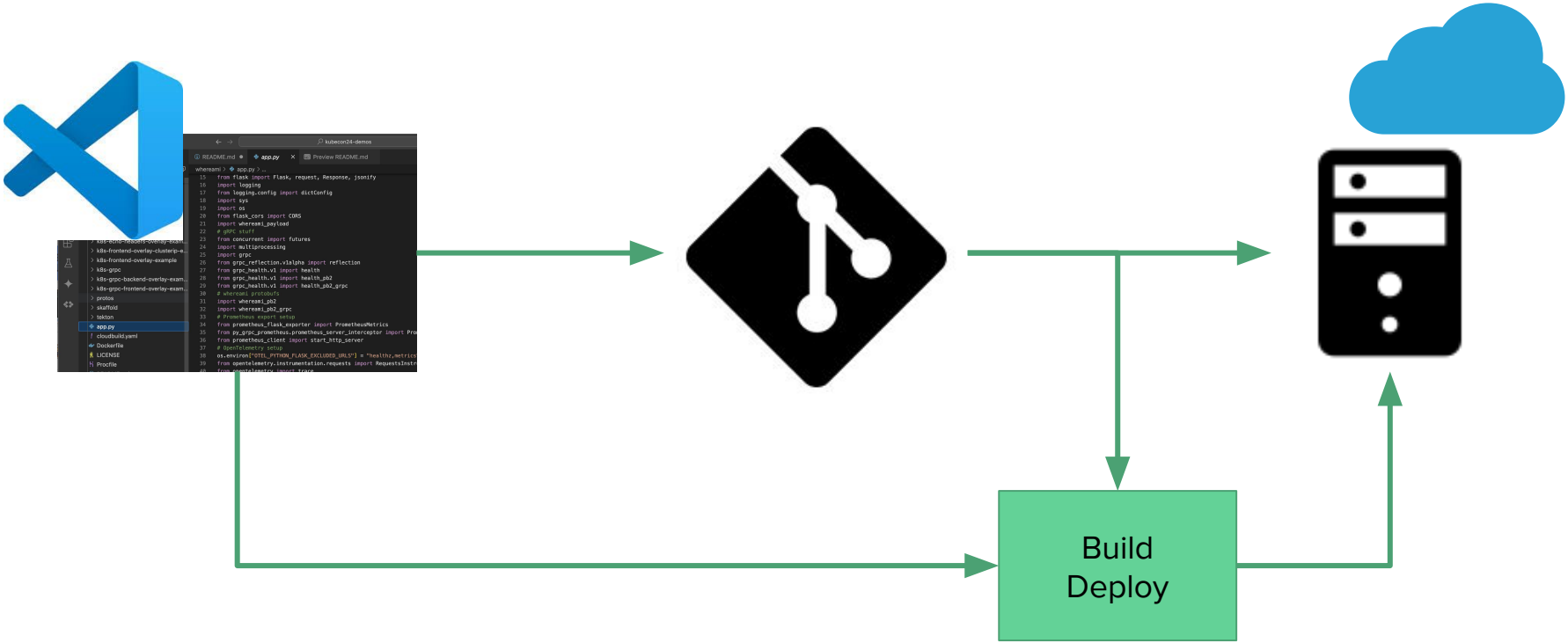


Some Development and Platform Concerns:

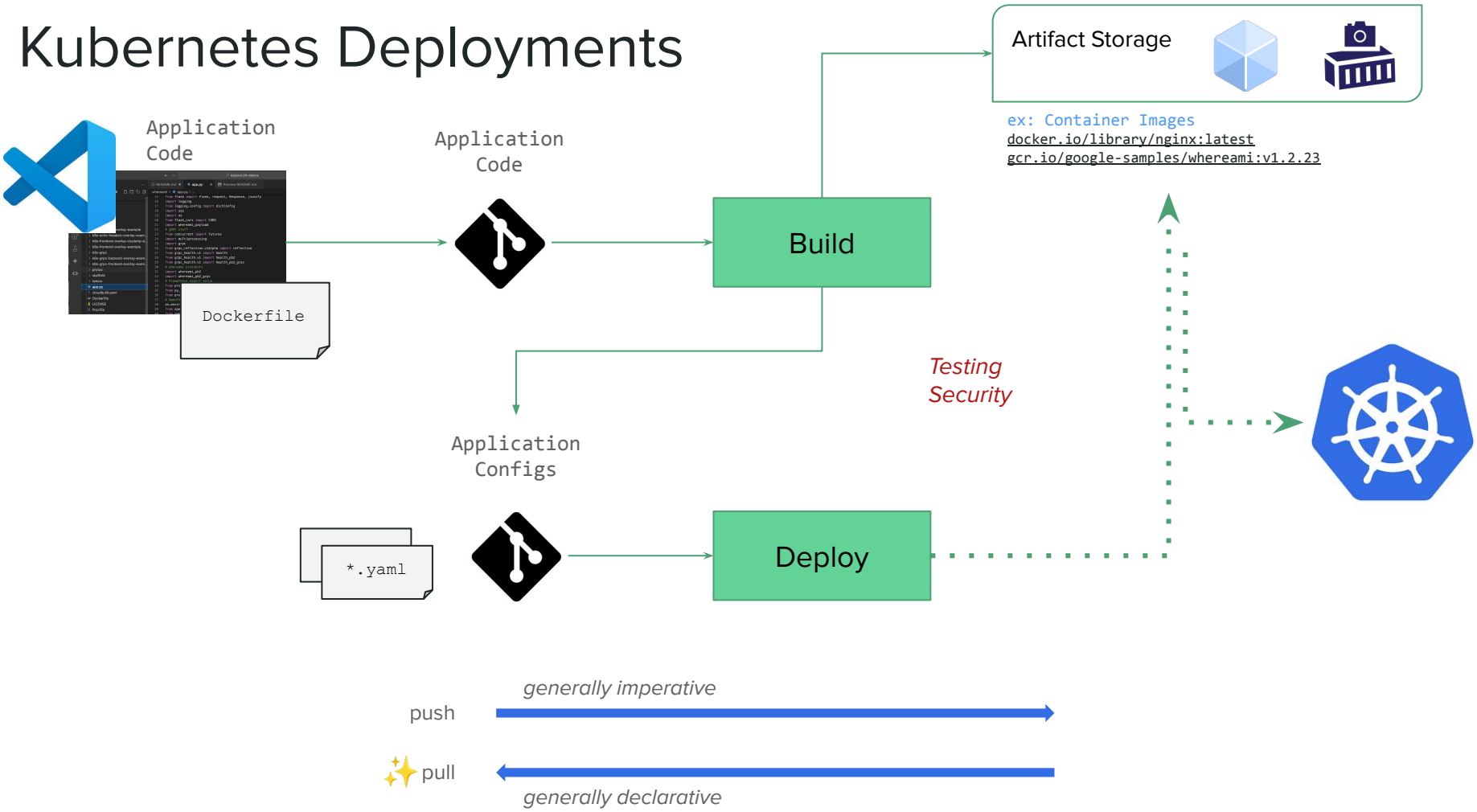
Hosting Environment | Version Control System | Application Code and Dependencies | Database Information | Domain and DNS | Security Information | Environment Variables | Secrets Management | Observability, Monitoring and Logging | Secure Software Supply Chain

CI/CD Systems!

Basic Deployment



Kubernetes Deployments



SKAFFOLD

Developer Workflow

JENKINSX

Jenkins

Templating | Packaging | Configuration

CI/CD Tools

Manual Deploy

imperative

```
$ cat << EOF | kubectl create -f -
apiVersion: apps/v1
kind: Deployment
metadata:
  name: hello-kubecon
spec:
  replicas: 1
  selector:
    matchLabels:
      app: hello-kubecon
  template:
    metadata:
      labels:
        app: hello-kubecon
    spec:
      containers:
      - name: hello-kubecon
        image: gcr.io/google-samples/whereami:v1.2.22
        ports:
        - containerPort: 8080
EOF
```

Manual Deploy

declarative

```
$ kubectl apply -f whereami.yaml

$ kubectl apply -f whereami/
```

imperative

```
$ kubectl run \
--image=us-docker.pkg.dev/google-samples/containers/gke/whereami:v1.2.22
\ --expose --port 8080 whereami
```

Skaffold

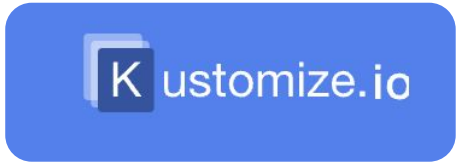
Skaffold is an open-source tool developed by Google that simplifies and streamlines the development workflow for containerized applications

- Lightweight and Client-Side
- Cross-Environment Compatibility
- Optimized Development Loop

```
$ skaffold dev

$ docker build

$ docker tag

$ docker push

# edit Kubernetes manifests

$ kubectl apply -f

$ kubectl logs
```

https://skaffold.dev/docs/init/

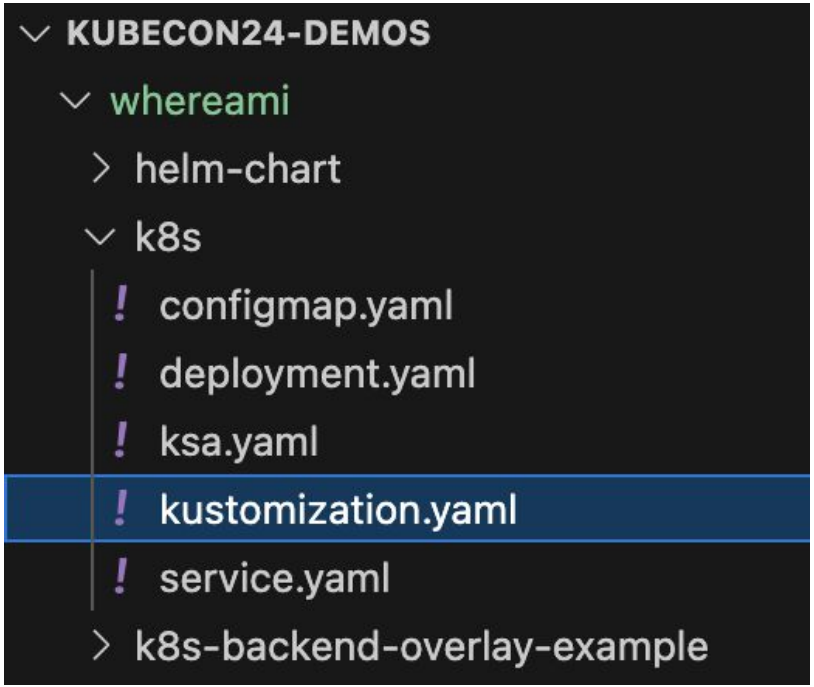
Kustomize



- Manages Kubernetes configuration without templates
- Uses base and overlay system for easy customization
- Streamlines management of different environments
- Generates resources like ConfigMaps and Secrets
- Organizes and composes resource collections

Kustomize - Key Concepts

- Layering: Base, Overlays, Patches
- Base: Defines common settings.
- Overlays: Modify base for specific environments.
- Patches: Make changes without altering originals.



Using Kustomize

```
~/whereami
├── k8s
│   ├── deployment.yaml
│   ├── kustomization.yaml
│   └── service.yaml
├── k8s-backend-overlay-example
│   ├── cm-flag.yaml
│   ├── kustomization.yaml
│   └── service-type.yaml
└── k8s-frontend-overlay-clusterip-example
    ├── cm-flag.yaml
    ├── kustomization.yaml
    └── service-type.yaml
```

```
kubectl apply -k k8s
serviceaccount/whereami created
configmap/whereami created
service/whereami created
deployment.apps/whereami created
```

```
resources:
- ksa.yaml
- deployment.yaml
- service.yaml
- configmap.yaml
```

base

```
nameSuffix: "-backend"
commonLabels:
  app: whereami-backend
resources:
- ../k8s
patches:
- path: cm-flag.yaml
  target:
    kind: ConfigMap
- path: service-type.yaml
  target:
    kind: Service
```

overlay

Visual example of a templating pattern

```
apiVersion: v1
kind: ServiceAccount
metadata:
  labels:
    app: {{ include "whereami.fullname" . }}
  name: {{ include "whereami.fullname" . }}
  namespace: {{.Release.Namespace}}
```

Helm - Key Concepts

Package manager like apt or yum
Around since 2015

Helps manage Kubernetes applications

Helm charts help define, install, and upgrade kube apps

Helm manages dependencies within different components in an application

image from https://helm.sh/

Helm - Charts!

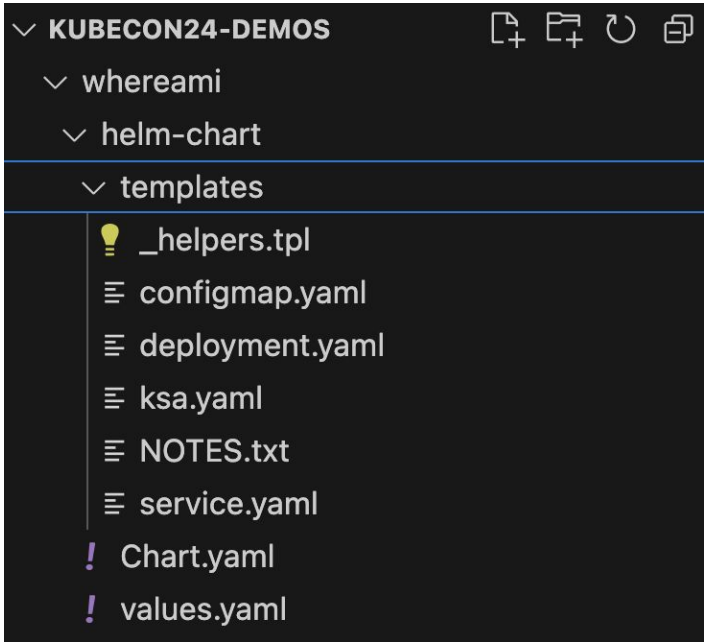
A Helm chart is a collection of files that describe a related set of Kubernetes resources and make it easy to version and share applications.

Charts are easy to create, version, share and publish.

Charts typically include:

- YAML manifests for Kubernetes resources
- Templates for generating Kubernetes manifest files
- Values files for configuring the templates
- Metadata about the chart itself

helm/chartmuseum



Set up Helm and install a Chart

```
$ brew install helm
```

```
$ helm search hub where
```

URL	CHART VERSION	APP VERSION	DESCRIPTION
https://artifacthub.io/packages/helm/romanow-he...	1.5.0	8.3.4	Grafana allows you to query, visualize, alert o...
https://artifacthub.io/packages/helm/romanow-he...	1.5.0	1.8.4	The Time Series Data Platform where developers ...

```
$ helm install whereami \
oci://us-docker.pkg.dev/google-samples/charts/whereami \
–version 1.2.22
```

Pipelines

- Set of Tasks executed in defined order
- Built-in support for common CI/CD tasks (build, test, deploy)
- Conditional execution and parallel tasks
- Pipelines create an audit trail in code
- Generally cover source control, build, test, staging, and finally deploy

Jenkins - Key Concepts

- Step: a single task!
- Stage: defines a conceptually distinct subset of tasks performed through the entire Pipeline
- Node: a machine which is part of the Jenkins environment and is capable of executing a Pipeline.

Jenkins - Pipelines

- Scripted Pipelines offer flexibility and control
- Declarative Pipelines use simpler, predefined structure
- Jenkinsfiles, using Groovy syntax, define Pipelines

```
pipeline {
    agent any

    environment {
        REGISTRY = 'your-docker-registry'
        IMAGE_NAME = 'whereami'
        IMAGE_TAG = 'latest'
        KUBECONFIG_CREDENTIALS_ID = 'kubeconfig-credentials'
    }

    stages {
        stage('Checkout') {
            steps {
                checkout scm
            }
        }

        stage('Build Docker Image') {
            steps {
                script {
                    docker.build("${REGISTRY}/${IMAGE_NAME}:${IMAGE_TAG}")
                }
            }
        }

        stage('Push Docker Image') {
            steps {
                script {
                    docker.withRegistry("https://${REGISTRY}", 'docker-credentials') {
                        docker.image("${REGISTRY}/${IMAGE_NAME}:${IMAGE_TAG}").push()
                    }
                }
            }
        }

        stage('Deploy to Kubernetes') {
            steps {
                script {
                    withCredentials([file(credentialsId: KUBECONFIG_CREDENTIALS_ID, variable: 'KUBECONFIG')]) {
                        sh 'kubectl apply -f k8s/deployment.yaml'
                    }
                }
            }
        }
    }

    post {
        always {
            cleanWs()
        }
    }
}
```

Tekton

Launched 2019 as part of Google's Knative project

Spun off in 2019 to the Continuous Delivery Foundation

Runs as an extension on clusters

Provides a set of building blocks for creating CI/CD pipelines that can build, test, and deploy across multiple cloud providers or on-prem systems.

CLI - tkn

https://raw.githubusercontent.com/cdfoundation/artwork/main/tekton/horizontal/color/tekton-horizontal-color.svg

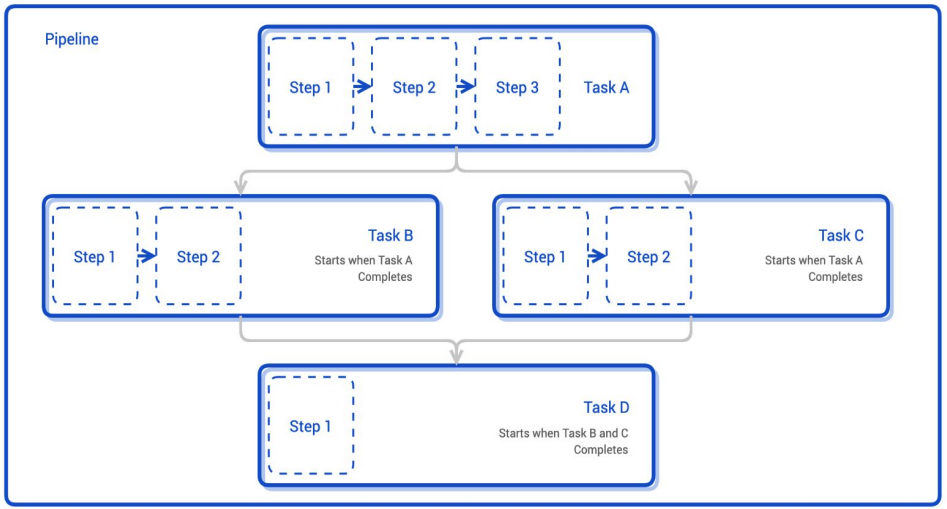
Tekton - Key Concepts

Steps - most basic unit and represents a specific operation in a CI/CD workflow

Tasks - collection of ordered steps

Pipelines - collection of tasks

Triggers - event-based pipelines



https://tekton.dev/docs/concepts/overview/

Tekton - Set Up a TaskRun

```
kubectl apply –f hello-world.yaml
task.tekton.dev/hello created
```

```yaml
apiVersion: tekton.dev/v1beta1
kind: Task
metadata:
  name: hello
spec:
  steps:
    - name: echo
      image: alpine
      script: |
        #!/bin/sh
        echo "Hello World"
```

```
kubectl apply –f hello-world-run.yaml
taskrun.tekton.dev/hello-task-run created
```

```yaml
apiVersion:
tekton.dev/v1beta1
kind: TaskRun
metadata:
  name:
hello-task-run
spec:
  taskRef:
    name: hello
```

```
kubectl get taskrun hello-task-run
NAME             SUCCEEDED  REASON     STARTTIME  COMPLETIONTIME
hello-task-run   True       Succeeded  15s        1s
```

https://tekton.dev/docs/concepts/overview/

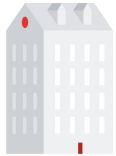
Argo CD

Declarative, GitOps continuous delivery tool for Kubernetes

Argo Workflows

Kubernetes-native workflow engine supporting DAG and step-based workflows

argo



Argo Events

Event based dependency management for Kubernetes

Argo Rollouts

Advanced Kubernetes deployment strategies such as Canary and Blue-Green

https://github.com/deploywithjoy/kubecon24-demos/tree/develop/whereami/argo

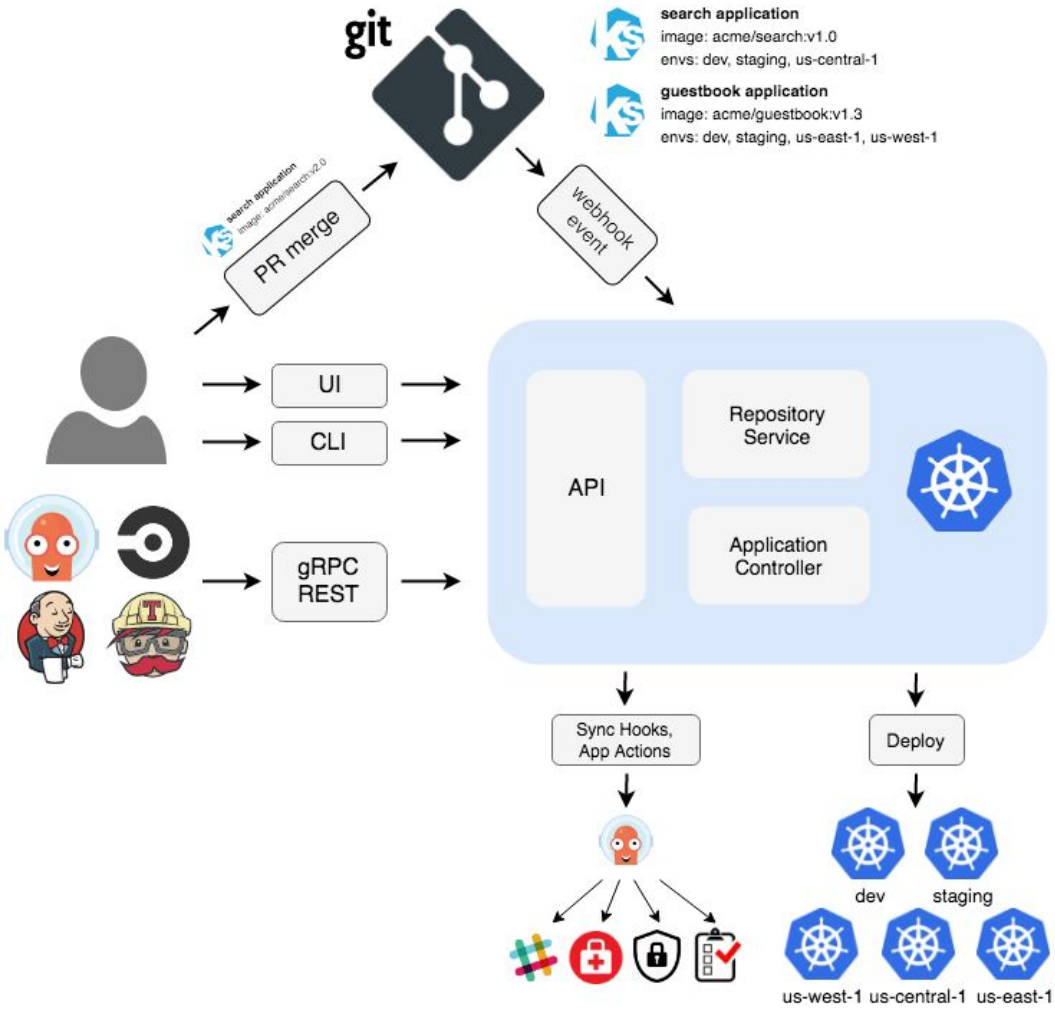
Argo CD

Focus on the “CD” part of CI/CD

Application definitions, configurations, and environments should be declarative and version controlled.

Application deployment and lifecycle management should be automated, auditable, and easy to understand.

https://github.com/argoproj/argo-cd



Key Resources

Application

An instance of an application defined by git source and destination cluster/namespace

Project

A group of Applications

Repo

Repository as secret

Kubernetes Manifests

kustomize | helm | yaml | jsonnet

```yaml
# Argo
apiVersion: argoproj.io/v1alpha1
kind: Application
metadata:
  name: whereami
  namespace: argocd
spec:
  project: default
  source:
    repoURL: 'https://github.com/deploywithjoy/kubecon24-demos.git'
    targetRevision: HEAD
    path: whereami/argo
  destination:
    server: 'https://kubernetes.default.svc'
    namespace: whereami
  syncPolicy:
    automated:
      prune: true
      selfHeal: true
    syncOptions:
      - CreateNamespace=true
```

Setup Argo

```
$ kubectl create namespace argocd

$ kubectl apply -n argocd -f
    \ https://raw.githubusercontent.com/argoproj/argo-cd/stable/manifests/install.yaml
```

Use Argo

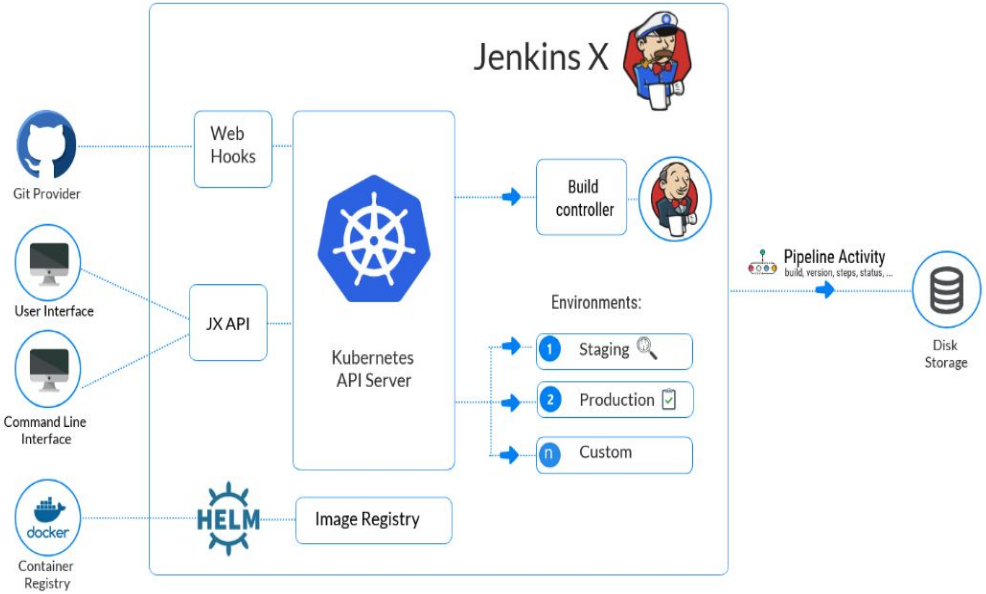
```
$ argocd app list
```

…or Argo Dashboard or API

Jenkins X

- GitOps
- Tekton Pipeline Orchestration
- ChatOps Integration
- Developer Experience and CLI
- Integration with Open-Source Projects

Jenkins X - Key Concepts



https://jenkins-x.io/about/concepts/

Source Repositories: Creates file structure and sets up tools.

Environments: Handles builds between environments using GitOps.

Pipelines!

Kubernetes Integration: Creates and configures Kubernetes cluster.

Single Command Operations: Create Git repos, webhooks, CD pipelines.

Jenkins X - ChatOps commands examples

`/lgtm`	This PR looks good to me - this command can be from anyone with access to the repo who is in the `OWNERS` file
`/test this`	Run the default test pipeline context for this PR
`/test (context)`	Run a specific test pipeline context by name
`/retest`	Rerun any failed test pipeline contexts for this PR
`/override (context)`	Override a failed pipeline context
`/hold`	Set this PR to not automerge even if it has been set `lgtm` and approved
`/hold cancel`	remove the `hold` label from the PR, allowing automerge
`/assign (user)`	assign the PR to the given (`user`)
`/cc (user)`	add the given `user` as a reviewer for the PR

So what tool should I use?

It depends!

Summary of CI/CD Tools

Tool	Focus	GitOps	Push or Pull	Project	K8S Native	CI	CD
ArgoCD	Declarative GitOps continuous delivery	x	Pull	CNCF Graduated	x	Via Argo events	X
Tekton	Cloud Native CI/CD pipelines; CI/CD framework	some	**Pull**	CNCF, CDF*	x	Building blocks	Building blocks
Jenkins	Traditional CI/CD	some	Both*	CNCF, CDF		x	x
Jenkins X	All In One CI/CD for Kubernetes (including ChatOps)	x	Pull	CNCF, CDF	x	x	x

*Continuous Delivery Foundation

Resources

kubectl

ArgoCD

Skaffold

Tekton

Kustomize

Jenkins

Helm

Jenkins X

cd.foundation

https://github.com/deploywithjoy/kubecon24-demos

Network and Find Your Pals this Week!

KubeCon | CloudNativeCon
North America 2023

Actual Footage of Murriel and Elizabeth
KubeCon + CloudNativeCon 2023 - Chicago

Thank you!

https://linktr.ee/mekubecon24

/in/emcponce

/in/murrielperez/

Talk Feedback