

From my Machine to the Cloud with Cloud-Native Tools

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Inner Loop Development Tools for Cloud-Native

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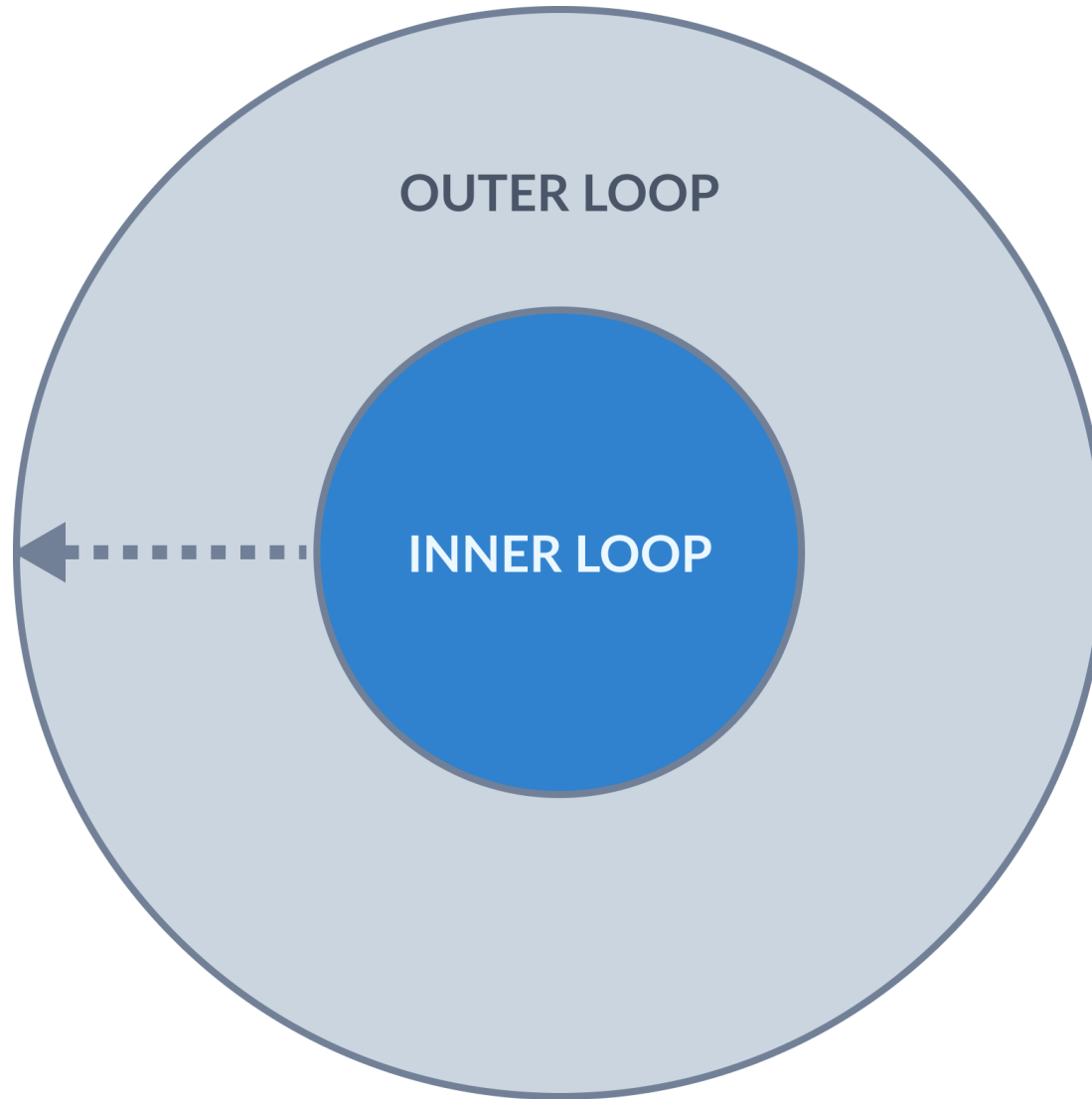
Inner Loop Development Tools for Cloud-Native

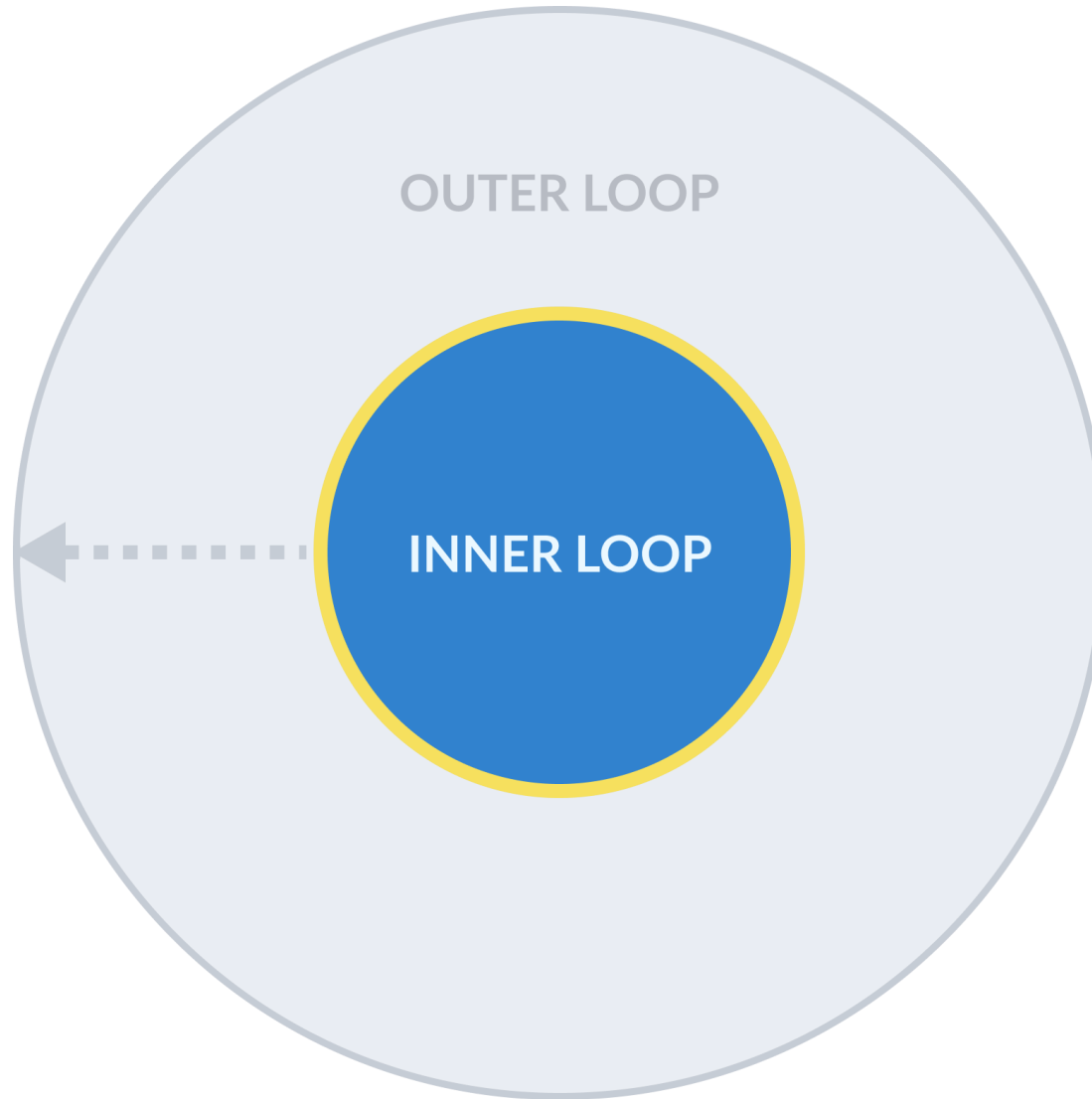
Tools for Developing Against Local Kubernetes Cluster

What is this talk about?

- Developer focused
- Running and deploying applications to Kubernetes
 - not developing *for* Kubernetes (operators, CRDs)
- Tools to make your life easier

Development Loops





Introduction

- I am Peter (@pjausovec)
- Software Engineer at Oracle
- Working on "cloud-native" stuff
- Books:
 - [Cloud Native: Using Containers, Functions, and Data to Build Next-Gen Apps](#)
 - SharePoint Development
 - VSTO For Dummies
- Courses:
 - Kubernetes Course (<https://startkubernetes.com>)
 - Istio Service Mesh Course (<https://learnistio.com>)

Code → Build → Test

Inner loop

- Execute the loop as fast as possible
- Get quality feedback
- Optimize the steps

Tools Grouping

1. Infrastructure
2. Code
3. Build
4. Test/debug

Infrastructure

Clusters

- [Minikube](#) (All)
- [Docker Desktop](#) (macOS/Windows)
- [kind](#) (All)
- [k3s](#) (Linux only)
- [MicroK8s](#) (Linux only)

Minikube

- Requires container or VM manager (Docker, Hyperkit, VirtualBox, ...)
- Multiple container runtimes
 - Docker, CRI-O, containerd
- Services
 - LoadBalancer (`minikube tunnel`) - actual IP address
 - NodePort (`minikube service` or `minikube ip` + the NodePort)
- Persistent volumes (`hostPath` is supported):
 - use `/data`, `/var/lib/minikube` or `/var/lib/docker` to persist files across reboots
- Add-ons available (Ingress, istio, metrics-server, efk, ...)
- Re-use the Docker daemon (`minikube docker-env`)

Docker Desktop

- Includes the suite of Docker tools (engine, CLI)
- Also supports Kubernetes
- Services:
 - Exposed through `localhost` + NodePort (e.g. `localhost:31234`)
 - Cons: only one LoadBalancer service

kind (kubernetes in docker)

- Uses Docker to create "node" containers
- Supports multi-node local clusters
- Services:
 - Exposed through localhost
- Requires more configuration (e.g. for local/private registries for example)

What to pick?

- Most mature: Minikube
- Most lightweight: kind
- Ease of use/installation: Docker Desktop
- Most realistic: cloud-managed cluster

Cluster management

- [Kubernetes CLI \(kubectl\)](#)
- [Kubernetes dashboard](#)
- [kubectx](#)
- [kubens](#)

Code

Create a new project

Run your code

Launch Live Share

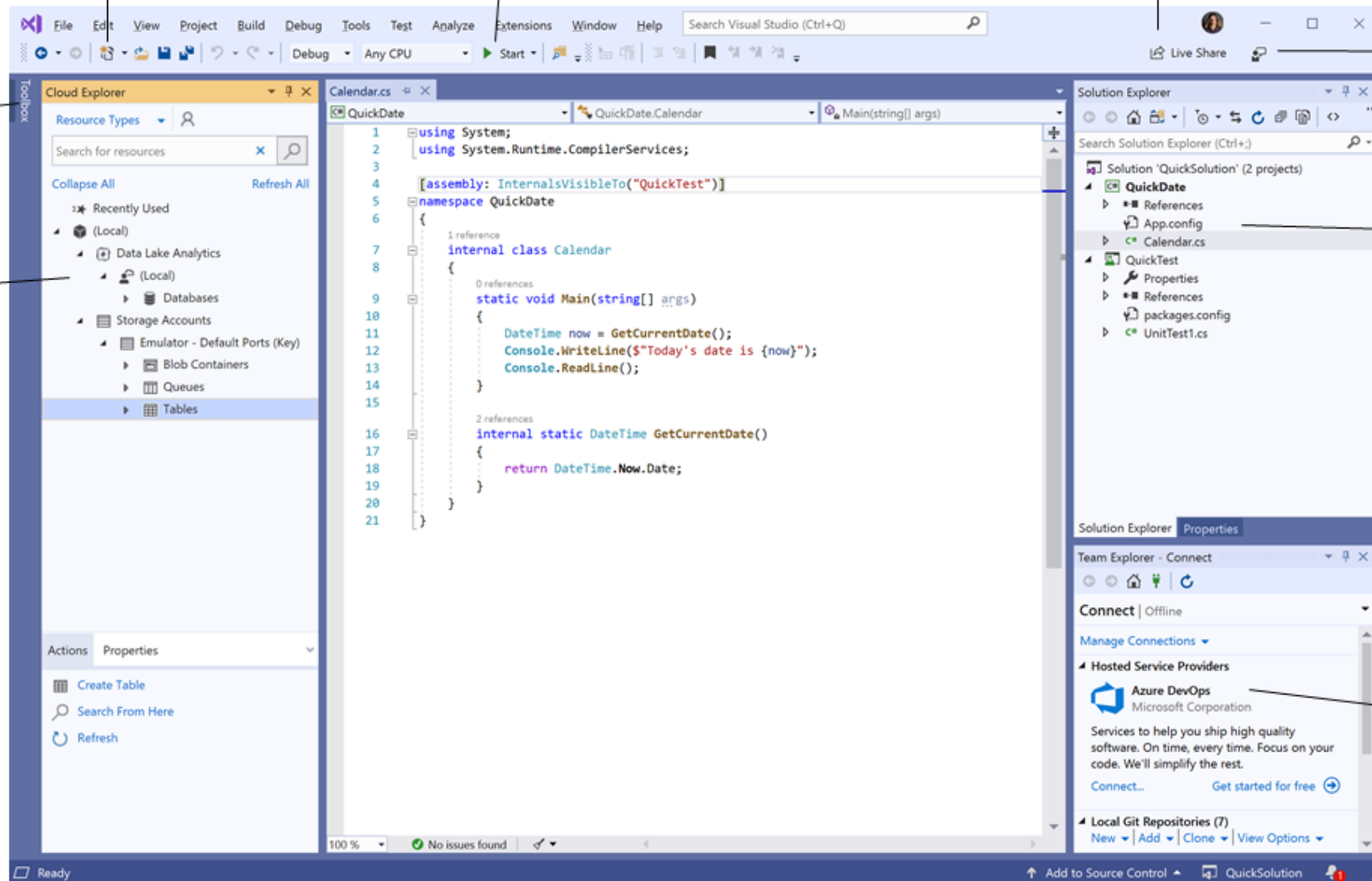
Send feedback

Add controls to your UI

Manage your Azure resources

Manage files, projects, and solutions

Collaborate on code projects with your team





JS utils.js src M

● JS blog-post.js src/components

▲ GATSBY-GRAPHQL-APP

- .cache
- node_modules
- public

▲ src

▲ components

JS blog-post.js

▸ images

▲ pages

JS index.js M

JS utils.js

📄 .gitignore

JS gatsby-config.js

JS gatsby-node.js

🔑 LICENSE

▲ OUTLINE

📦 <function>

🔗 blogPost

🔗 query

```
1 import { graphql } from "gatsby"
2 import React from "react"
3 import Image from "gatsby-image"
4
5 export default ({ data }) => {
6   const blogPost = d
7   return (
8     <div>
9       {blogP
10         blog
11         blog
12         <I
13       )}
14     <h1>{b
15     <div>P
16     <div d
17   </div>
18 )
19 }
20
```

var data: any ⓘ

- data
- dateFormat
- debug
- debugger
- decodeURI
- decodeURIComponent
- default
- defaultStatus
- delete
- departFocus
- devicePixelRatio
- dispatchEvent

PROBLEMS

TERMINAL

...

1: node



info ⓘ [wdm]: Compiled successfully.
info changed file at
WAIT Compiling...
9:51:57 AM

info ⓘ [wdm]: Compiling...
DONE Compiled successfully in 63ms
9:51:58 AM

Featured



Markdown All in One

Yu Zhang ⬇ 1.6M

★★★★★ **FREE**



AutoTrim

Nathan Ridley ⬇ 14.8K

★★★★★ **FREE**



Svelte for VS Code

Svelte ⬇ 6.5K

★★★★★ **FREE**



Back & Forth

Nick Rudenko ⬇ 6.3K

★★★★★ **FREE**



Windows Terminal Int

Daniel Imms ⬇ 432

★★★★★ **FREE**



TODO Highlight

Jonathan Clark ⬇ 215

★★★★★ **FREE**

Trending [this week](#) ▾



Yet another Discord P

satoqz ⬇ 196

★★★★★ **FREE**



Black

Jaakko ⬇ 147

★★★★★ **FREE**



Clash VSCode Snippet

Fndroid ⬇ 106

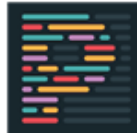
★★★★★ **FREE**



Gather

Microsoft ⬇ 416

★★★★★ **FREE**



Prettier+ESLint - Code

codeco ⬇ 136

★★★★★ **FREE**



Toggle Case

Pranshu Agrawal ⬇ 143

★★★★★ **FREE**

Most Popular

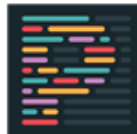
[See more](#) ➔













JS index.js X Makefile JS func.js X ! load-dep.yaml

src > functions > newsletter-subscription > JS func.js > ...

```

1  /**
2  * Copyright © 2019, Oracle and/or its affiliates. All rights reserved.
3  * The Universal Permissive License (UPL), Version 1.0
4  */
5
6  const fdk = require('@fnproject/fdk');
7  const nodemailer = require('nodemailer');
8
9  const sendMail = async ({ toEmail, { host, port, user, pass, approvedSender } }) => {
10     const transporter = nodemailer.createTransport({
11         host,
12         port,
13         secure: false,
14         auth: {
15             user,
16             pass
17         }
18     });
19
20     const mailOpts = {
21         from: approvedSender,
22         to: toEmail,
23         subject: 'Hello from Mushop',
24         html: 'Thanks for confirming your <b>subscription</b>!',
25     };
26
27     return transporter.sendMail(mailOpts).then((info) => {
28         return { 'messageId': info.messageId };
29     }, (err) => {

```

PROBLEMS 7 OUTPUT DEBUG CONSOLE TERMINAL

```

// Indicates whether each individual test should be reported during the run
// verbose: null,

// An array of regexp patterns that are matched against all source file paths before re-running tests in watch mode
// watchPathIgnorePatterns: [],

// Whether to use watchman for file crawling
// watchman: true,
};

```

peterj at Peters-MBP in ~/projects/oci-cloudnative/src/storefront on master

\$

JS index.js X

src > api > api > catalogue > JS index.js > ...

```

1  /**
2  * Copyright © 2019, Oracle and/or its affiliates. All rights reserved.
3  * The Universal Permissive License (UPL), Version 1.0
4  */
5  (function () {
6      'use strict';
7
8      const express = require("express"),
9      endpoints = require("../endpoints"),
10      app = express.Router();
11
12      app.get("/catalogue/images*", function (req, res, next) {
13          const url = endpoints.catalogueUrl + req.url.toString();
14          req.svcClient().get(url, { responseType: 'stream' })
15              .then(response => response.data.pipe(res))
16              .catch(next);
17      });
18
19      app.get("/catalogue*", function (req, res, next) {
20          req.svcClient()
21              .get(endpoints.catalogueUrl + req.url.toString())
22              .then(({ data }) => res.json(data))
23              .catch(next);
24      });
25
26      app.get("/categories", function (req, res, next) {
27          req.svcClient()
28              .get(endpoints.catalogueUrl + req.url.toString())
29              .then(({ data }) => res.json(data))

```

1: bash, bash

peterj at Peters-MBP in ~/projects/oci-cloudnative/src on master

\$ cd functions/

l

peterj at Peters-MBP in ~/projects/oci-cloudnative/src/functions on master

\$ ls

total 0

drwxr-xr-x 3 peterj staff 96 Jun 30 12:34 ./

drwxr-xr-x 17 peterj staff 544 Jun 30 12:34 ../

drwxr-xr-x 8 peterj staff 256 Jun 30 12:34 newsletter-subscription/

peterj at Peters-MBP in ~/projects/oci-cloudnative/src/functions on master

\$



OPEN EDITORS 1 UNSAVED

JS index.js src/api/he...

M Makefile src/api

JS func.js src/fu... 1

JS server.js src/api

! load-dep.yaml src...

OCI-CLOUDNATIVE

JS mock.js

> test

.dockerignore

.gitignore

JS app.js

JS config.js

Dockerfile

JS jest.config.js

M Makefile

{ } package.json

{ } package-lock.json

README.md

JS server.js

THIRDPARTY.md

VERSION

> OUTLINE

src > api > JS server.js > app.listen() callback

```
1  /**
2  * Copyright © 2019, Oracle and/or its affiliates. All rights reserved.
3  * The Universal Permissive License (UPL), Version 1.0
4  */
5  const app = require('./app');
6  const config = require("./config");
7
8  app.listen(config.env('PORT') || 3000, function () {
9    var port = this.address().port;
10   config.
11   console. env (property) env: (key: a..., port);
12   });
13    keyMap
14    mockMode
15    prod
16    session
17    test
```

Extensions/plugins

- Code formatters ([Prettier](#), [Language specific list](#))
 - "Remove that extra line/space"
 - "use spaces not tabs"
 - "use tabs not spaces", ...
- [Code linters collection](#)
 - "disallow unnecessary parentheses"
 - "require default case in switch statements"
 - "disallow else after return in an if"

Extensions/plugins

- [Docker](#)
- [Kubernetes](#)
- Specific cloud-flavored extensions

Build

Example: React Typescript

- Prerequisites: Dockerfile(s), YAML file(s)

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- Install dependencies (`npm install`) (40 seconds)
- `npm start` (30 seconds)
 - Transpile `.ts` → `.js`
 - Launches dev server

Example: React Typescript

- Prerequisites: Dockerfile(s), YAML file(s)
- Install dependencies (`npm install`) (40 seconds)
- `npm start` (30 seconds)
 - Transpile `.ts` → `.js`
 - Launches dev server
- Build a Docker image (`docker build ...`) (60 seconds)

Example: React Typescript

- Prerequisites: Dockerfile(s), YAML file(s)
- Install dependencies (`npm install`) (40 seconds)
- `npm start` (30 seconds)
 - Transpile `.ts` → `.js`
 - Launches dev server
- Build a Docker image (`docker build ...`) (60 seconds)
- Push the image to the registry (`docker push ...`) (50 seconds)

Example: React Typescript

- Prerequisites: Dockerfile(s), YAML file(s)
- Install dependencies (`npm install`) (40 seconds)
- `npm start` (30 seconds)
 - Transpile `.ts` → `.js`
 - Launches dev server
- Build a Docker image (`docker build ...`) (60 seconds)
- Push the image to the registry (`docker push ...`) (50 seconds)
- Deploy to Kubernetes (`kubectl apply -f ...`) (10 seconds)

One application = ~20 seconds

X applications = ?!

Build (& Deploy)

Skaffold

- Command line tool from Google
- Iterate locally and automatically deploy to the cluster
- Handles build, push and deploy
- Can integrate with CI/CD pipelines

ksync

- Syncs local files to the container inside the cluster
- Similar to Skaffold, but involves more commands
- Installs a ksync pod inside the cluster

Tilt

- Full automation workflow:
 - watching files
 - building images
 - updating environment
- Full UI

Deployment

- [Keel](#)
 - Automates Kubernetes deployment updates
 - No CLI (uses labels, annotations)
- [Helm](#)
 - Package manager for Kubernetes
 - Manage multiple resources with a single command

DEMO

Skaffold & Tilt

Debug/test

```
kubectl logs ws-server-76b957bb99-6zn65 -f  
--all-containers
```

```
$ kubectl logs ws-server-76b957bb99-fjjsq -f

> server@0.1.0 dev /app
> nodemon --watch src -e ts,ejs --exec npm run dev:start

[nodemon] 2.0.4
[nodemon] to restart at any time, enter `rs`
[nodemon] watching path(s): src/**/*.js
[nodemon] watching extensions: ts,ejs
[nodemon] starting `npm run dev:start`

> server@0.1.0 dev:start /app
> npm-run-all build start

> server@0.1.0 build /app
> npm-run-all clean lint tsc

> server@0.1.0 clean /app
```

stern

- color coded output
- automatically picks up new pods
- `stern ws-server-76b957bb99-6zn65` === `stern ws-server` === `stern ws`

```
$ stern ws
+ ws-server-76b957bb99-fjjsq > ws-server
ws-server-76b957bb99-fjjsq ws-server
ws-server-76b957bb99-fjjsq ws-server > server@0.1.0 dev /app
ws-server-76b957bb99-fjjsq ws-server > nodemon --watch src -e ts,ejs --exec npm run
ws-server-76b957bb99-fjjsq ws-server
ws-server-76b957bb99-fjjsq ws-server [nodemon] 2.0.4
ws-server-76b957bb99-fjjsq ws-server [nodemon] to restart at any time, enter `rs`
ws-server-76b957bb99-fjjsq ws-server [nodemon] watching path(s): src/**/*.
ws-server-76b957bb99-fjjsq ws-server [nodemon] watching extensions: ts,ejs
ws-server-76b957bb99-fjjsq ws-server [nodemon] starting `npm run dev:start`
ws-server-76b957bb99-fjjsq ws-server
ws-server-76b957bb99-fjjsq ws-server > server@0.1.0 dev:start /app
ws-server-76b957bb99-fjjsq ws-server > npm-run-all build start
ws-server-76b957bb99-fjjsq ws-server
ws-server-76b957bb99-fjjsq ws-server
ws-server-76b957bb99-fjjsq ws-server > server@0.1.0 build /app
ws-server-76b957bb99-fjjsq ws-server > npm-run-all clean lint tsc
ws-server-76b957bb99-fjjsq ws-server
```

kail - Kubernetes tAIL

- Matching by:
 - services
 - deployments
 - replicaset

```
kail --deploy=my-deployment
```

```
kail --node=node-1
```

```
kail --svc=hello-svc
```

kail

```
$ kail --ns default
default/web-7749d9b5c4-9tmm6[web]:
default/web-7749d9b5c4-9tmm6[web]: > web@0.1.0 start /app
default/web-7749d9b5c4-9tmm6[web]: > npm run tailwind:css && react-scripts st
default/web-7749d9b5c4-9tmm6[web]:
default/web-7749d9b5c4-9tmm6[web]:
default/web-7749d9b5c4-9tmm6[web]: > web@0.1.0 tailwind:css /app
default/web-7749d9b5c4-9tmm6[web]: > tailwind build src/styles/tailwind.css -
obal.css
default/web-7749d9b5c4-9tmm6[web]:
default/web-7749d9b5c4-9tmm6[web]:
default/web-7749d9b5c4-9tmm6[web]:   tailwindcss 1.4.6
default/web-7749d9b5c4-9tmm6[web]:
default/web-7749d9b5c4-9tmm6[web]:   🚀 Building... src/styles/tailwind.css
default/ws-server-76b957bb99-fjjsq[ws-server]:
default/ws-server-76b957bb99-fjjsq[ws-server]: > server@0.1.0 dev /app
default/ws-server-76b957bb99-fjjsq[ws-server]: > nodemon --watch src -e ts,ej
default/ws-server-76b957bb99-fjjsq[ws-server]:
default/ws-server-76b957bb99-fjjsq[ws-server]: [nodemon] 2.0.4
default/ws-server-76b957bb99-fjjsq[ws-server]: [nodemon] to restart at any ti
default/ws-server-76b957bb99-fjjsq[ws-server]: [nodemon] watching path(s): sr
default/ws-server-76b957bb99-fjjsq[ws-server]: [nodemon] watching extensions:
```

kubebox

1:Pods2:Debug

Pods [default]

NAME	STATUS	AGE
curl	Running	12d 0h
my-deployment-7d6f48ccd9-9mnpn	Running	4d 0h
sleep-on-the-job-f9ht8	Completed	1d 0h
three-sleeps-on-the-job-bk56h	Completed	1d 0h
three-sleeps-on-the-job-ccqmw	Completed	23h 58m
three-sleeps-on-the-job-r98k8	Completed	23h 59m
web-frontend-7fc5dfbf65-g8sfx	Running	12d 0h

Resources

M:Memory	C:CPU	T:Net
Unable to locate cAdvisor pod on node minikube		

Logs [nginx] Running

```
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
```

k9s

Context: minikube
Cluster: minikube
User: minikube
K9s Rev: 0.20.5 [22575]
K8s Rev: v1.18.3

<0> all
<1> default

<a> Attach
<ctrl-d> Delete
<d> Describe
<e> Edit
<?> Help
<ctrl-k> Kill



Pods(default)[8]

NAME	READY	RESTARTS	STATUS	IP	NODE	AGE
alpine-k8s	1/1	2	Running	172.17.0.6	minikube	7d23h
curl	1/1	4	Running	172.17.0.2	minikube	12d
my-deployment-7d6f48ccd9-9mnpn	1/1	1	Running	172.17.0.3	minikube	4d
sleep-on-the-job-f9ht8	0/1	0	Completed	172.17.0.8	minikube	24h
three-sleeps-on-the-job-bk56h	0/1	0	Completed	172.17.0.8	minikube	23h
three-sleeps-on-the-job-ccqmw	0/1	0	Completed	172.17.0.8	minikube	23h
three-sleeps-on-the-job-r98k8	0/1	0	Completed	172.17.0.8	minikube	23h
web-frontend-7fc5dfbf65-g8sfx	1/1	1	Running	172.17.0.7	minikube	12d

<pod>

Testing

- [Popeye](#) (Best practices)
- [fortio](#) (Performance)
- [kube-monkey](#) (Chaos)
- [PowerfulSeal](#) (Chaos)

Popeye

```
• default/web-7749d9b5c4-qmkkg.....🤖
🔗 [POP-206] No PodDisruptionBudget defined.
🤖 [POP-300] Using "default" ServiceAccount.
🤖 [POP-301] Connects to API Server? ServiceAccount token is mounted.
🤖 [POP-302] Pod could be running as root user. Check SecurityContext/image.
🐳 web
🤖 [POP-106] No resources requests/limits defined.
🤖 [POP-102] No probes defined.
🔗 [POP-108] Unnamed port 3000.
🤖 [POP-306] Container could be running as root user. Check SecurityContext/Image.
• default/ws-server-76b957bb99-fjjsq.....🤖
🔗 [POP-206] No PodDisruptionBudget defined.
🤖 [POP-300] Using "default" ServiceAccount.
🤖 [POP-301] Connects to API Server? ServiceAccount token is mounted.
🤖 [POP-302] Pod could be running as root user. Check SecurityContext/image.
🐳 ws-server
🤖 [POP-106] No resources requests/limits defined.
🤖 [POP-102] No probes defined.
🔗 [POP-108] Unnamed port 8999
```

Fortio

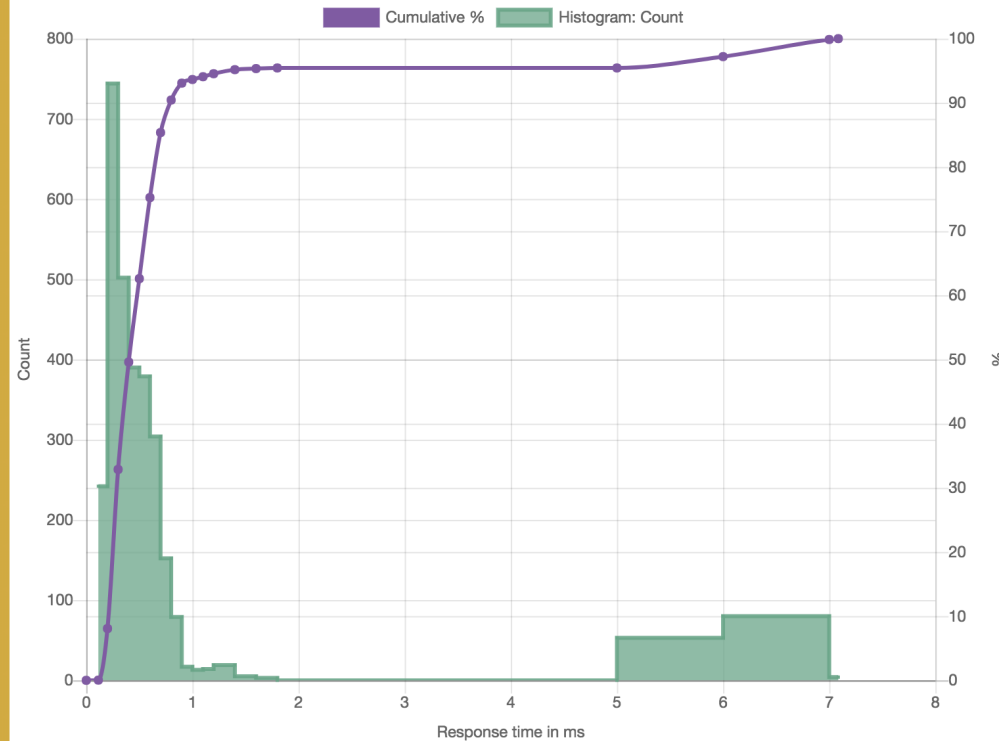
Φορτίο (fortio) v1.0.0-pre

Up for 4m15.4s (since Thu Jun 14 11:20:40 2018).

Fortio <http://localhost:8080/echo?delay=250us:30,5ms:5&status=503:0.5,429:1.5>



Fortio - <http://localhost:8080/echo?delay=250us:30,5ms:5&status=503:0.5,429:1.5> - 2018-06-14 11:24:56
Response time histogram at 1000 target qps (999.6 actual) 8 connections for 3s (actual time 3s), 2.37% errors
min 0.114 ms, average 0.701 ms, p50 0.4 ms, p75 0.6 ms, p90 0.79 ms, p99 6.68 ms, p99.9 7.02 ms, max 7.086 ms



Update: Time axis min ms, max ms, logarithmic: ☐ - Count axis logarithmic: ☐

Starting at 1000 qps with 8 thread(s) [gomax 8] for 3s : 375 calls each (total 3000)
Ended after 3.001307816s : 3000 calls. qps=999.56

Debug

- [Telepresence](#)
 - Debug services locally
 - Proxies calls to Kubernetes
- [Squash](#)
 - Debug services inside the cluster (Go, Python, Node, Java)
- [Garden](#) (Test)
 - Testing environment

How to get started?

- Docker Desktop
- Kubernetes CLI (kubectl) + kubectlx/kubens
- Skaffold

Resources (1/5)

- [Minikube](#) (Infra)
- [Docker Desktop](#) (Infra)
- [kind](#) (Infra)
- [k3s](#) (Infra)
- [MicroK8s](#) (Infra)
- [Kubernetes CLI \(kubectl\)](#) (Cluster Management)
- [Kubernetes dashboard](#)
- [kubectx](#) (Cluster Management)
- [kubens](#) (Cluster Management)

Resources (2/5)

- [VS Code](#) (Code)
- [Prettier](#) (Code)
- [Code formatters collection](#) (Code)
- [Code linters collection](#) (Code)
- [Docker](#) (Code)
- [Kubernetes](#) (Code)

Resources (3/5)

- [Scaffold](#) (Build)
- [ksync](#) (Build)
- [Tilt](#) (Build)
- [Keel](#) (Build/Deploy)
- [Helm](#) (Deploy)
- [Forge](#) (Build)
- [Okteto](#) (Build)

Resources (4/5)

- [stern](#) (Debug)
- [kail](#) (Debug)
- [kubetail](#) (Debug)
- [Kubebox](#) (Debug)
- [k9s](#) (Debug)
- [kubefwd](#) (Debug)
- [Telepresence](#) (Debug)
- [Inlets](#) (Debug)

Resources (5/5)

- [Popeye](#) (Test)
- [Sonobuoy](#) (Test)
- [fortio](#) (Test/Performance)
- [kube-monkey](#) (Test/Chaos)
- [PowerfulSeal](#) (Test/Chaos)
- [Garden](#) (Test)

Thank you

Contact

- Twitter: [@pjausovec](#)
- Blog: <https://learncloudnative.com>
- Slides: <https://slides.peterj.dev>
- Github with Demos: <https://github.com/peterj/gids-cloud-native-tools-demos>