

# Kubernetes native development workflows



Belastingdienst





Belastingdienst

```
[peter@bld:~/openshift]$ oc new-app https://my-git-repo.nl/CollectTaxRepo
```



# Motivation



Belastingdienst



OPENSIFT



Skupper



argo



buildah



odo



dekorate

# CNCF Cloud Native Interactive Landscape

The cloud native landscape (jms, pdf), serverless landscape (jms, pdf), and member landscape (jms, pdf) are dynamically generated below. Please open a pull request to correct any issues. Gopel/Logo error not open source. Last Updated: 2023-10-09/10:41:04

You are viewing 1,257 cards with a total of 4,011,079 stars and funding of \$50.1B.

Landscape    Card Mode    Members    Serverless    Warm

The landscape is organized into several main sections:

- App Databases and Development:** Includes Database, Streaming & Messaging, Application Definition & Image Build, and Continuous Integration & Delivery.
- Observability & Management:** Includes Monitoring & Instrumentation, Discovery, Call, Service Proxy, API Gateway, and Serverless.
- Runtime:** Includes Cloud Native Storage, Container Runtime, and Cloud Native Network.
- Provisioning:** Includes Automation & Configuration, Container Registry, Security & Compliance, and Key Management.
- Platform:** Includes Certified Kubernetes - Distribution, Certified Kubernetes - Hosted, Certified Kubernetes - Installer, and PaaS/Container Service.
- Serverless:** Includes Members and CD Framework Landscape.
- Observability and Analysis:** Includes Monitoring.
- Logging:** Includes fluentd.





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LinkedIn



Peter Keerweer



Java Developer at Tax Department

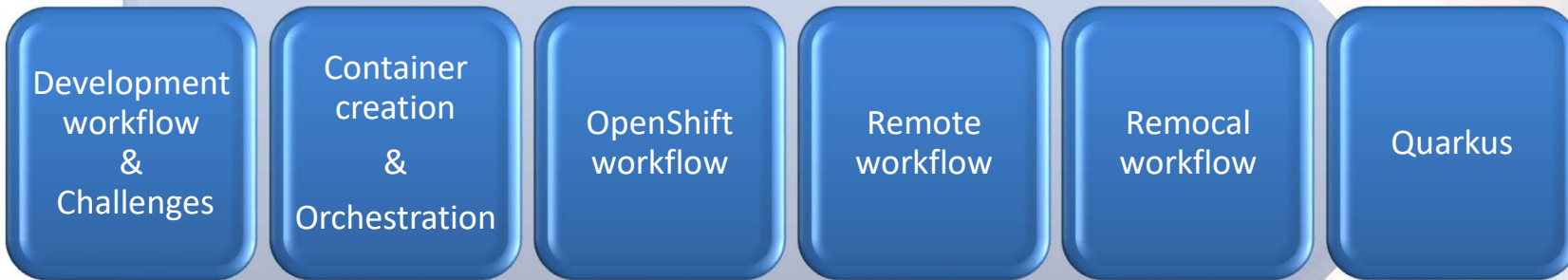


[pj.keerweer@belastingdienst.nl](mailto:pj.keerweer@belastingdienst.nl)





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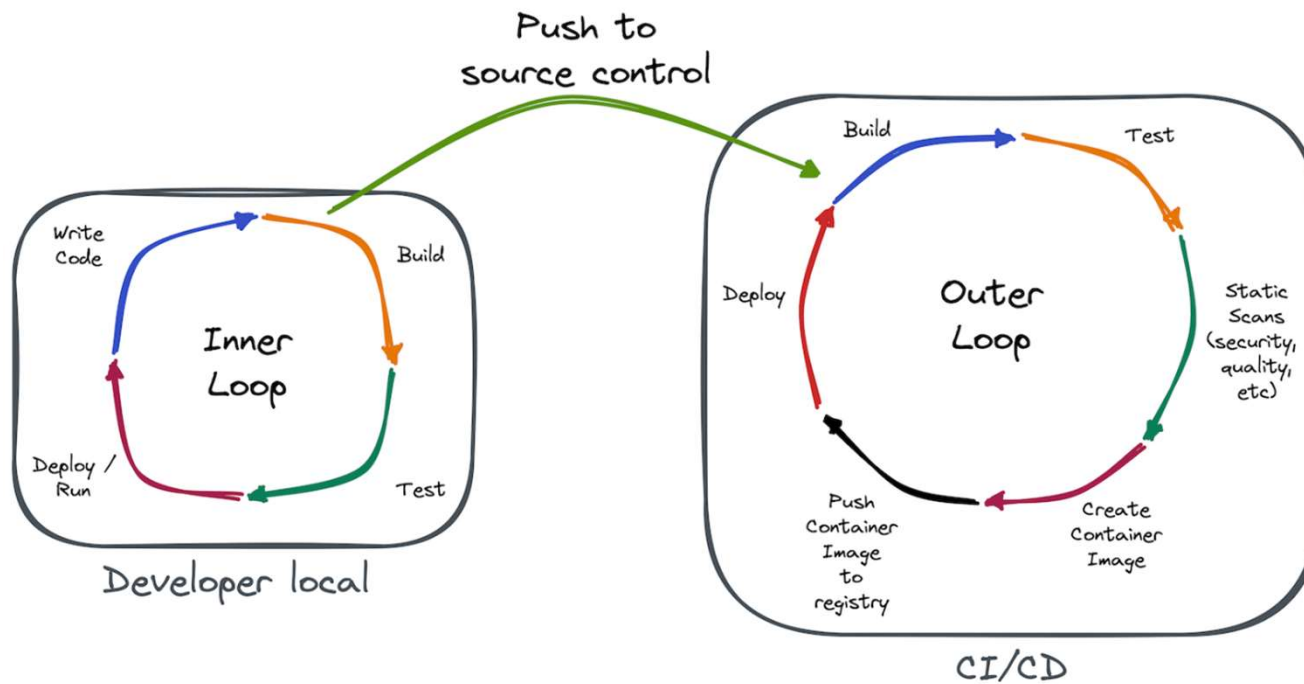
# Development workflow & Challenges



# Development workflow



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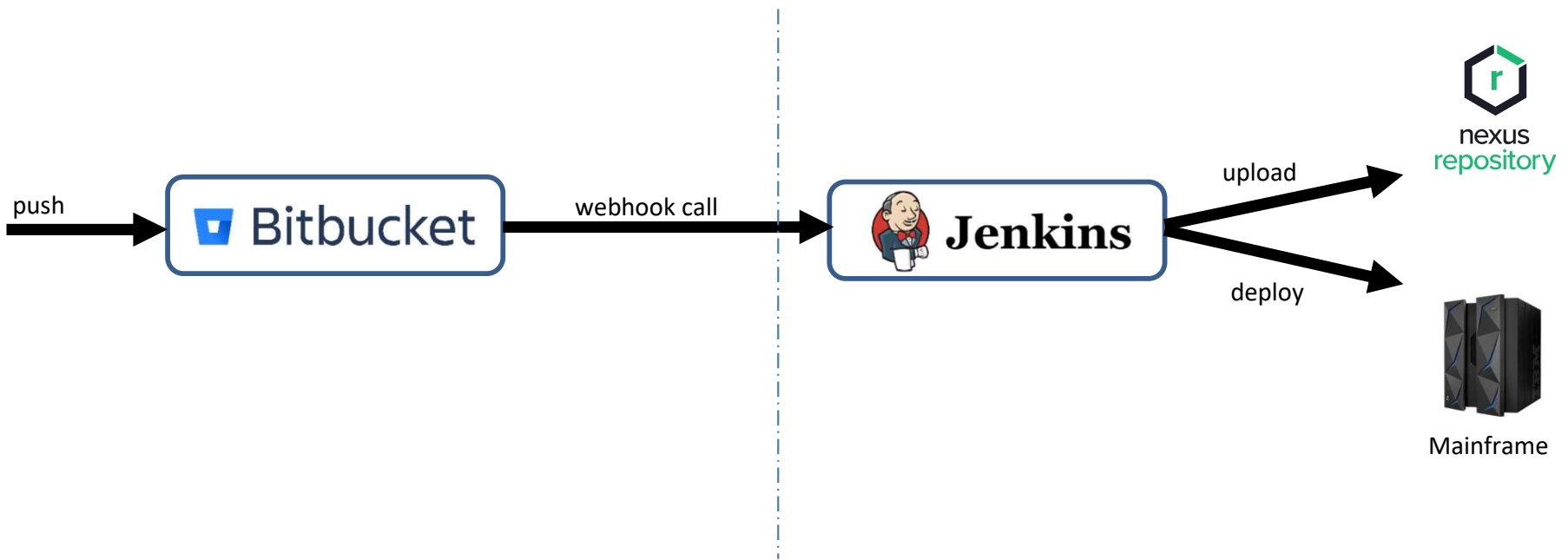




# Development workflow



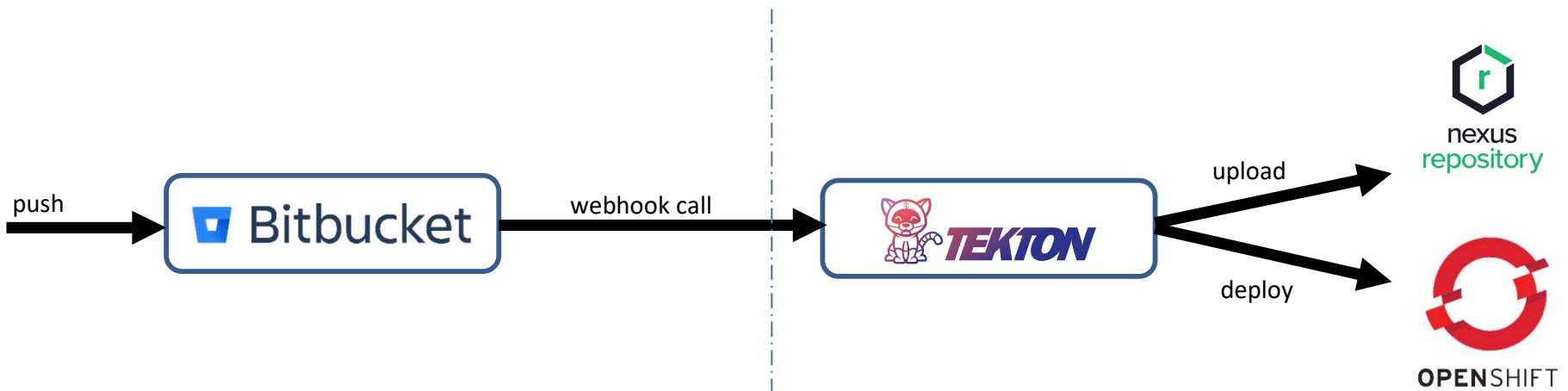
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# Development workflow



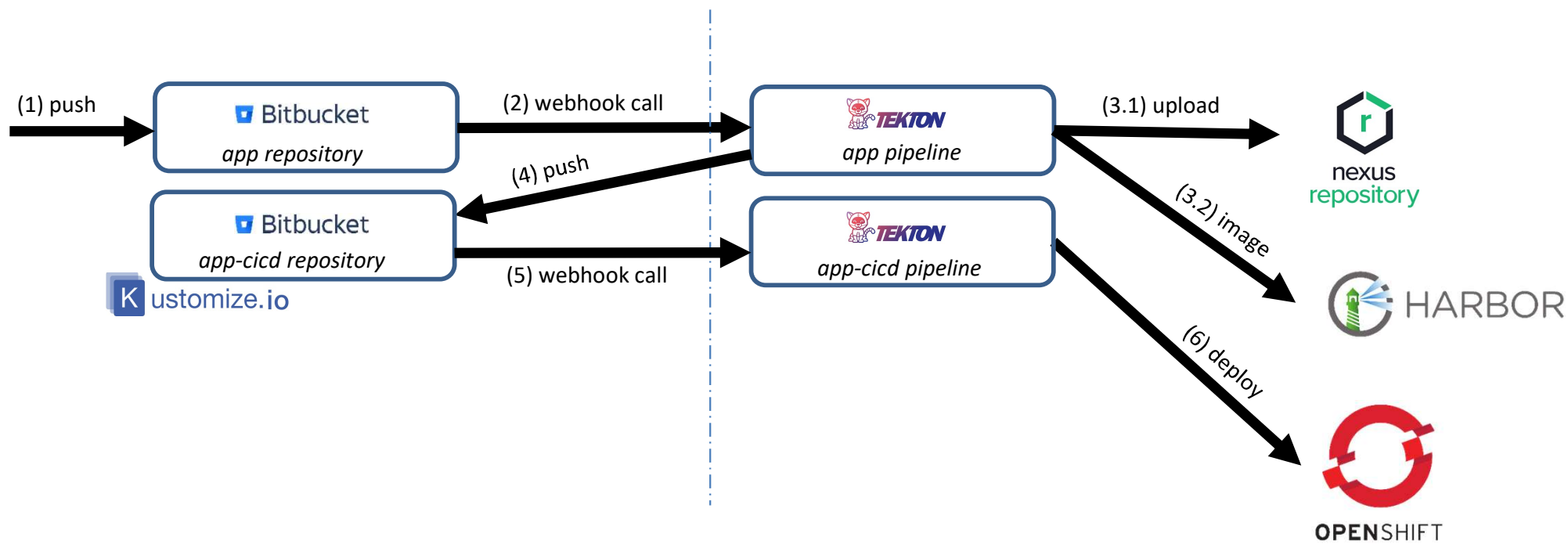
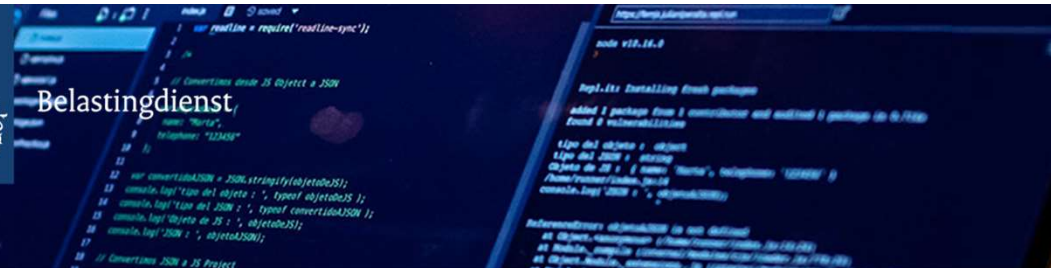
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# Development workflow



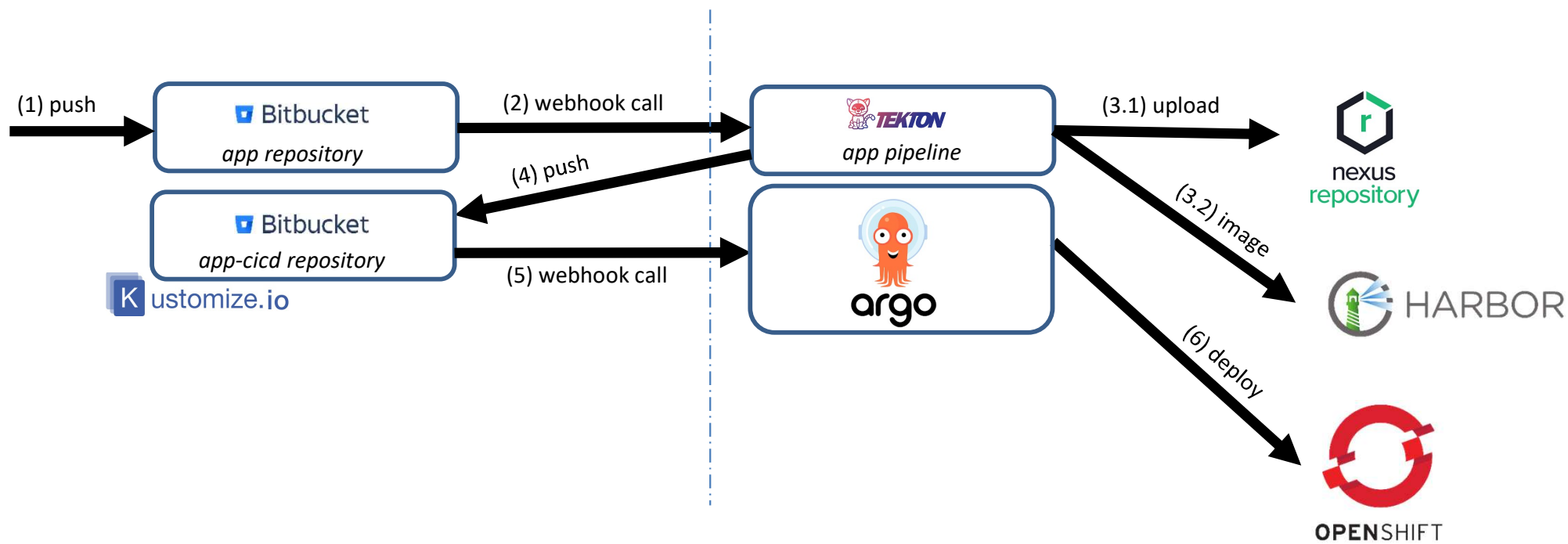
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# Development workflow



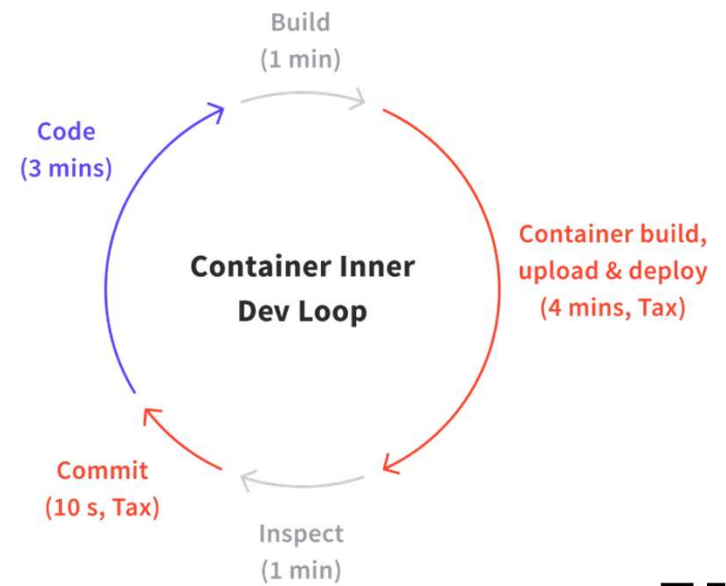
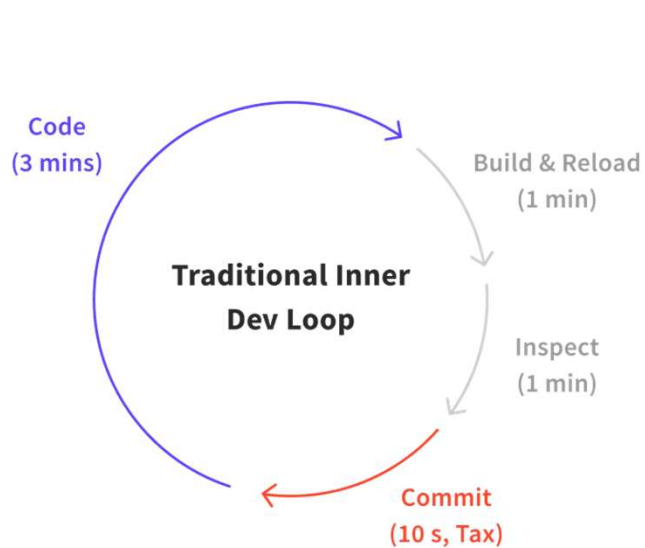
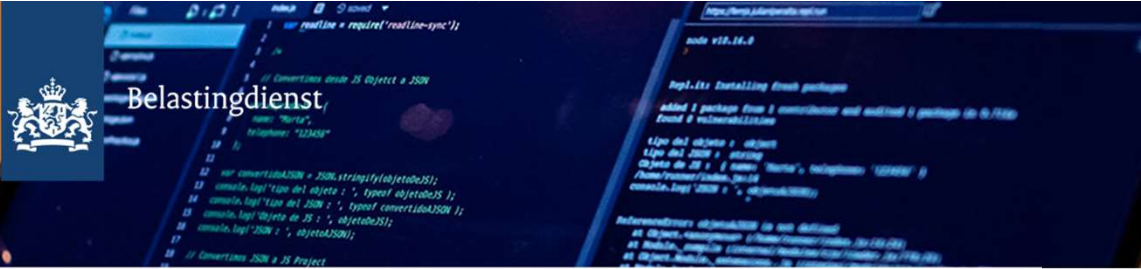
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# Challenges



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# Challenges



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Too much configuration



Debugging is a pain



Applications have so many moving parts



Spend too much time outside of the code



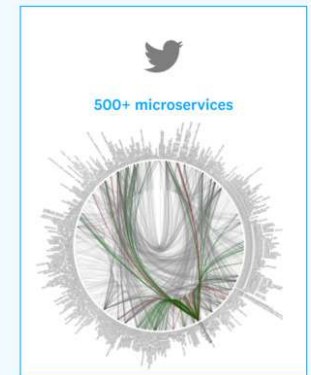
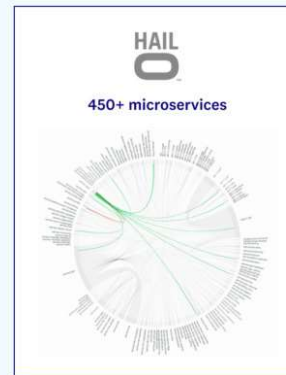
# Challenges



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- How to run a microservice locally that communicates with other microservices?
- Run all microservices locally?

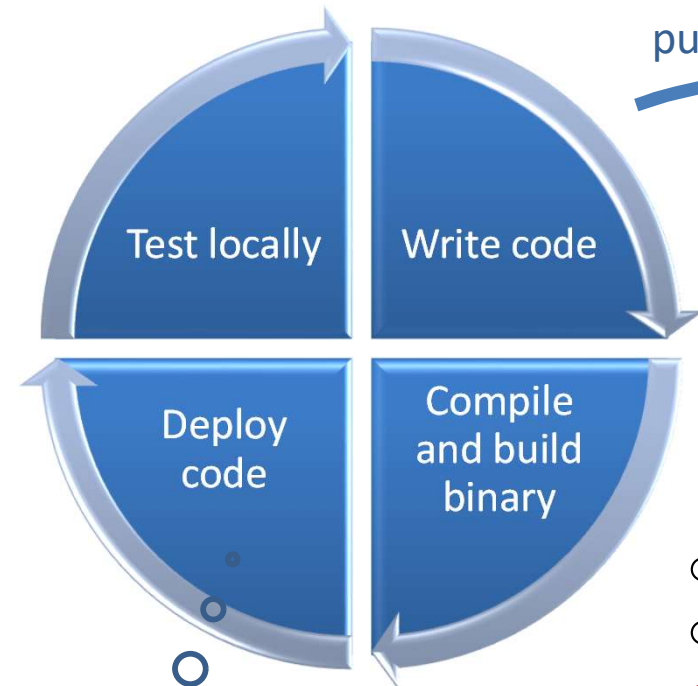




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push to source control

```
[user@jfall:~/demo]$ git commit -m 'works on my machine'
```



Setup runtime and dependencies

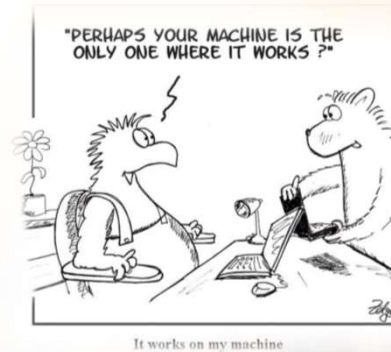
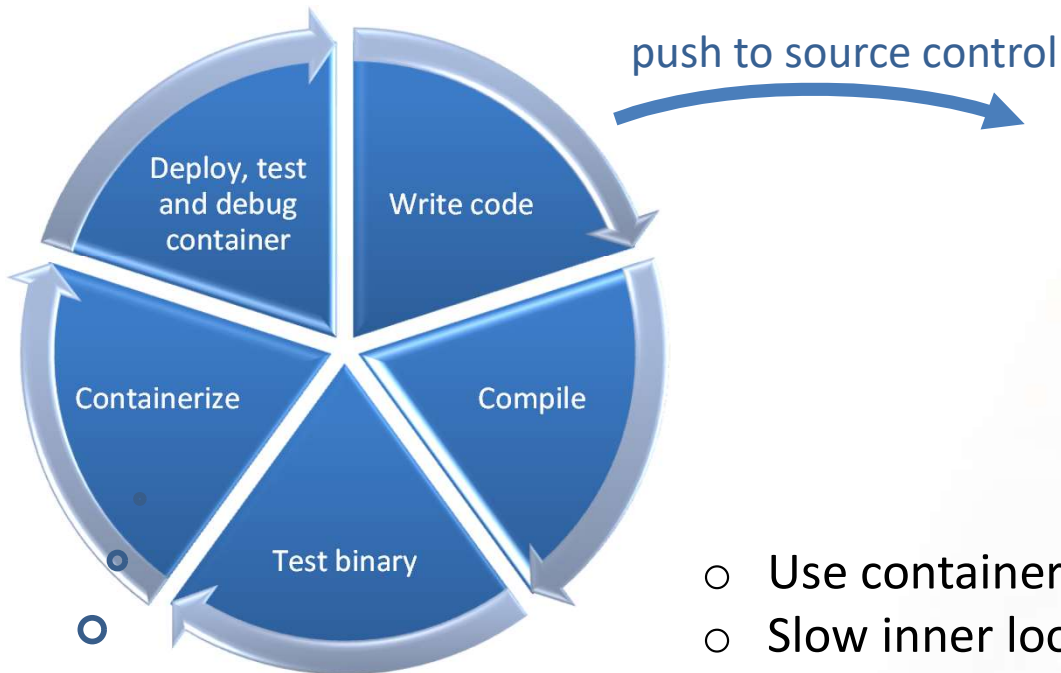
- No containers in development
- Containers created in outer loop
- **Development doesn't match production**







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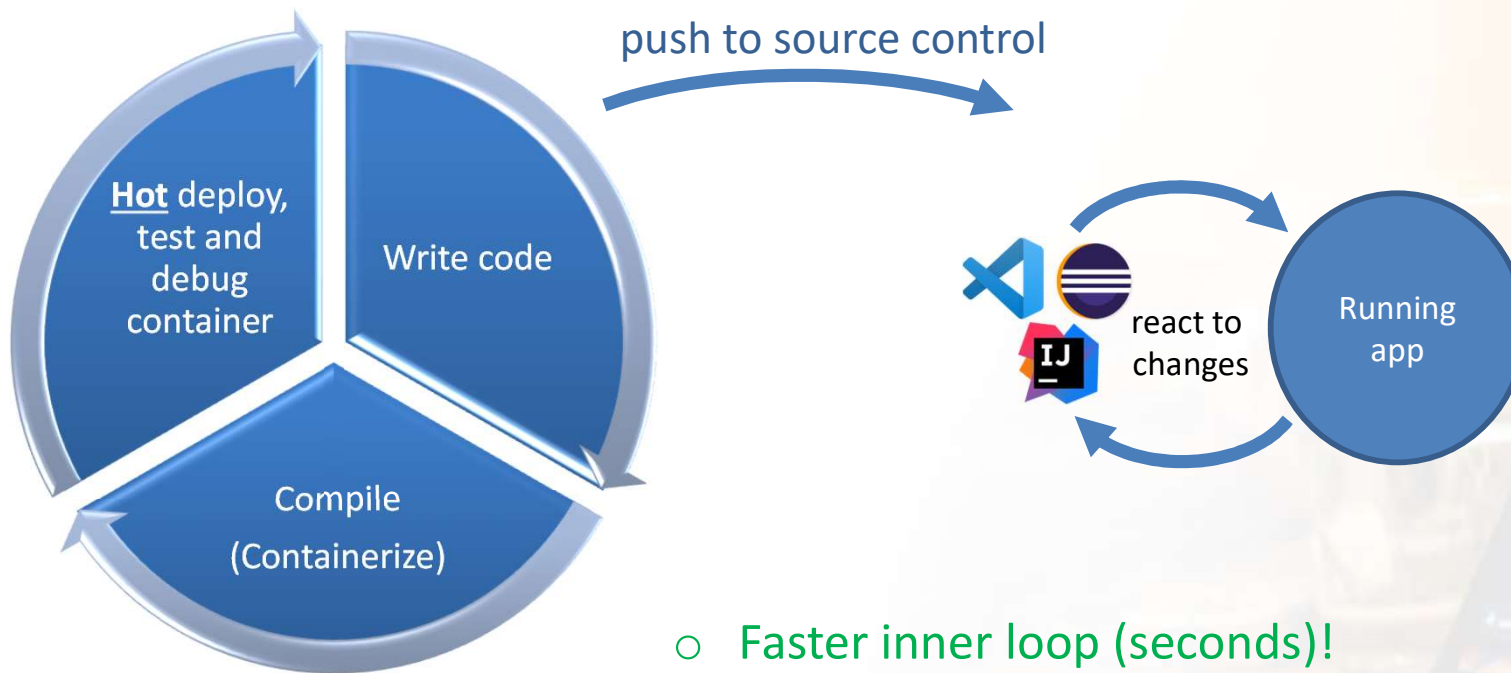
- Use containers in development
- Slow inner loop (minutes)!
- **Still doesn't match production**



Create /edit Dockerfile



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- Faster inner loop (seconds)!
- All problems solved? Not yet....





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# Container creation & Orchestration



# Container creation

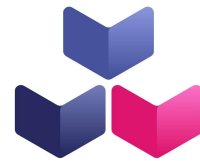


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// Converting desde JS Objeto a JSON  
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podman



Buildpacks.io



docker



buildah



source-to-image (s2i)



# Container creation



Belastingdienst



- OCI compliant containers
  - Open Container Initiative (OCI)



- Build a container locally
  - Dockerfile / Containerfile



podman

- Run container locally

```
[user@jfall:~/demo]$ podman run ubi8/ubi:8.3 echo 'Hello world!'  
Hello world!
```



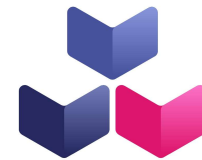
# Container creation



Belastingdienst



- Buildpacks
  - Build a container with *pack*
  - Uses *builder container*
  - No JDK, Maven or something else needed



Buildpacks.io

```
[user@jfall:~/demo]$ pack build myapp --builder paketobuildpacks/builder:base
```

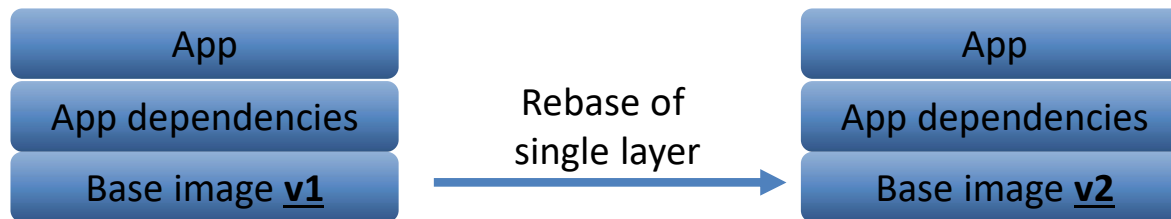
# Container creation



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- *Rebase* with Buildpacks



# Container creation



Belastingdienst

- Source-to-image (s2i)
  - Uses *builder image*
- Container creation process runs on cluster
- *BuildConfig*
  - OpenShift resource

```
apiVersion: build.openshift.io/v1
kind: BuildConfig
metadata:
  name: maven-webapp-app
spec:
  source: # input parameters of source
  strategy: # build strategy to use
  output: # registry details
  triggers: # list of triggers
```



# Container creation



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## ○ BuildConfig vs Tekton

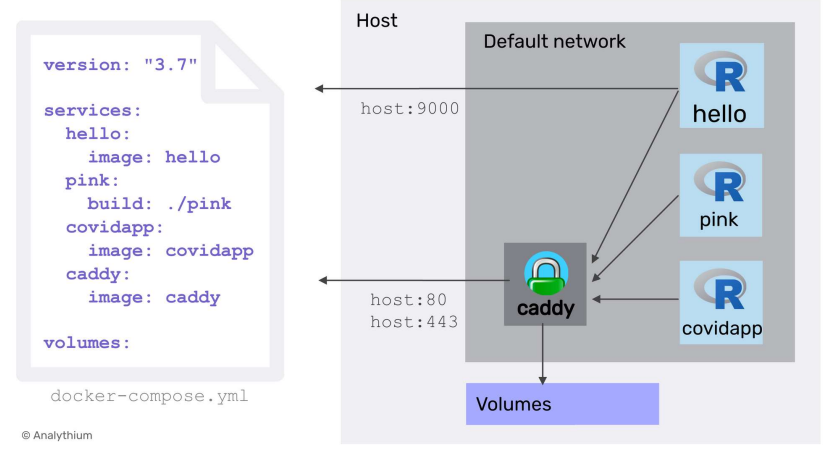
- BuildConfig *specific* for OpenShift
- **Quickly** build container on OpenShift with BuildConfig
- Build more **complex** pipelines with Tekton
- **Everything** what can be done with BuildConfig can be accomplished as well **with Tekton**



# Container orchestration



- Run multiple containers
  - docker-compose (feature-rich)
  - podman-compose
- *podman play kube*
  - Better integration with k8s
  - Run YAML locally and inside k8s
- Minishift (of Minikube)





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# OpenShift workflow



# OpenShift workflow



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- `oc new-app` command
  - Recognizes programming language
  - Detects Dockerfile

```
[user@jfall:~/demo]$ oc new-app https://my-git-server.nl/MyGitRepo
```

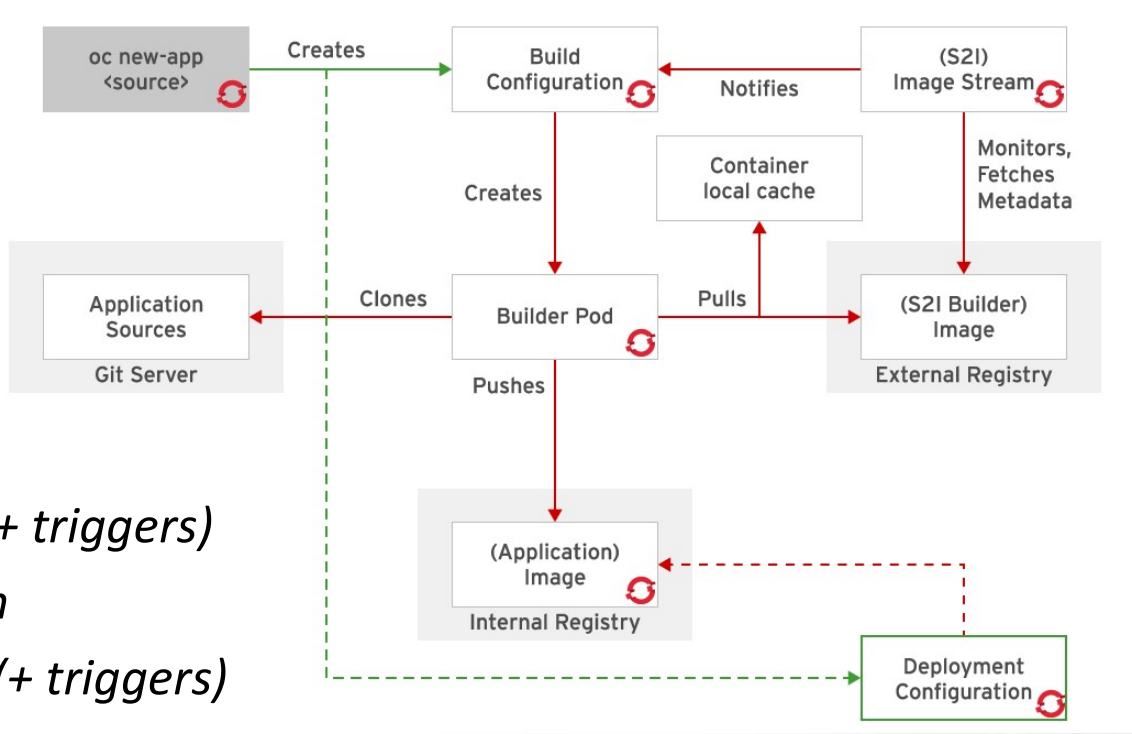
- BitBucket clone via SSH
  - Create SSH key pair
  - Create a (sealed) secret
  - Link to *builder* service account

```
[user@jfall:~/demo]$ oc secrets link builder bitbucket-secret
```

```
[peter@bld:~/openshift]$ oc new-app https://my-git-repo.nl/CollectTaxRepo
```



Belastingdienst



Resources:

- *BuildConfig (+ triggers)*
- *ImageStream*
- *Deployment (+ triggers)*
- *Service*
- *Route*



# OpenShift workflow



Belastingdienst



```
# Specify s2i image
```

```
[user@jfall:~/demo]$ oc new-app -i php https://my-git-server.nl/MyGitRepo
```

```
# Specify context-dir
```

```
[user@jfall:~/demo]$ oc new-app --context-dir=/test https://my-git-server.nl/MyGitRepo
```

```
# Specify a branch
```

```
[user@jfall:~/demo]$ oc new-app https://my-git-server.nl/MyGitRepo #beta-branch
```

```
# Build based on Dockerfile
```

```
[user@jfall:~/demo]$ oc new-app --strategy docker https://my-git-server.nl/MyGitRepo
```



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# Remote workflow



# Remote workflow



Belastingdienst



Eclipse Che

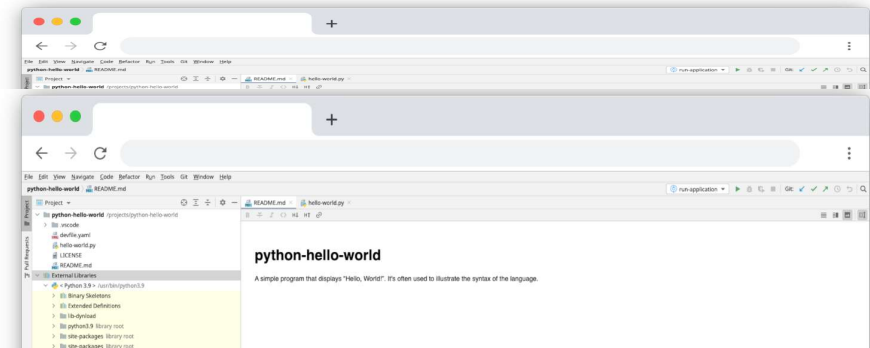


Eclipse Che™ | Features | How it Works | Extend | Docs | Blog

## Run your favorite IDE on Kubernetes

Create a workspace from a Git repository or sample

Start Now





# Remote workflow



Belastingdienst



OpenShift Dev Spaces



Eclipse Che

- OpenShift Dev spaces
  - Based on *Eclipse Che*
  - e.g. license management
- Extensions (CRD) to the Kubernetes API
  - DevSpace operator
  - DevWorkspace operator
- Universal Developer Image (UDI)



# Summary



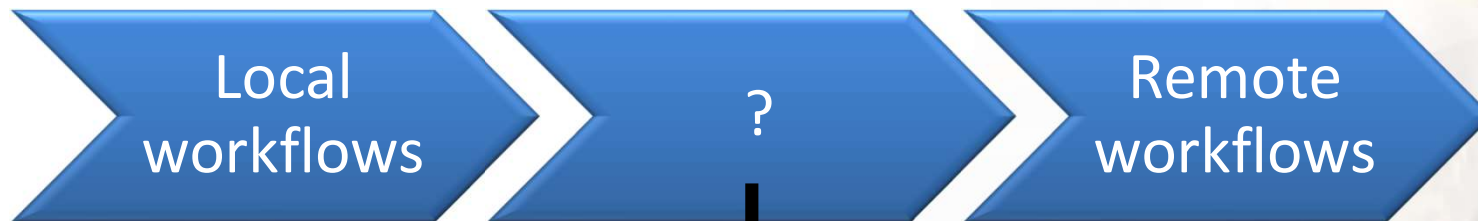
Belastingdienst



# Summary



Belastingdienst



**Local + Remote = Remocal**





Belastingdienst

# Remocal workflow



# Remocal workflow



Belastingdienst

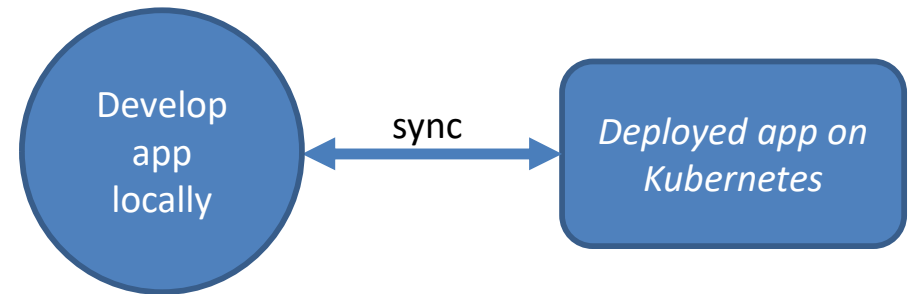


- **Approach 1:**

- develop locally + run remotely
- sync with remote app

- **Approach 2:**

- develop + run locally
- route remote traffic to local app



# Remocal workflow



Belastingdienst

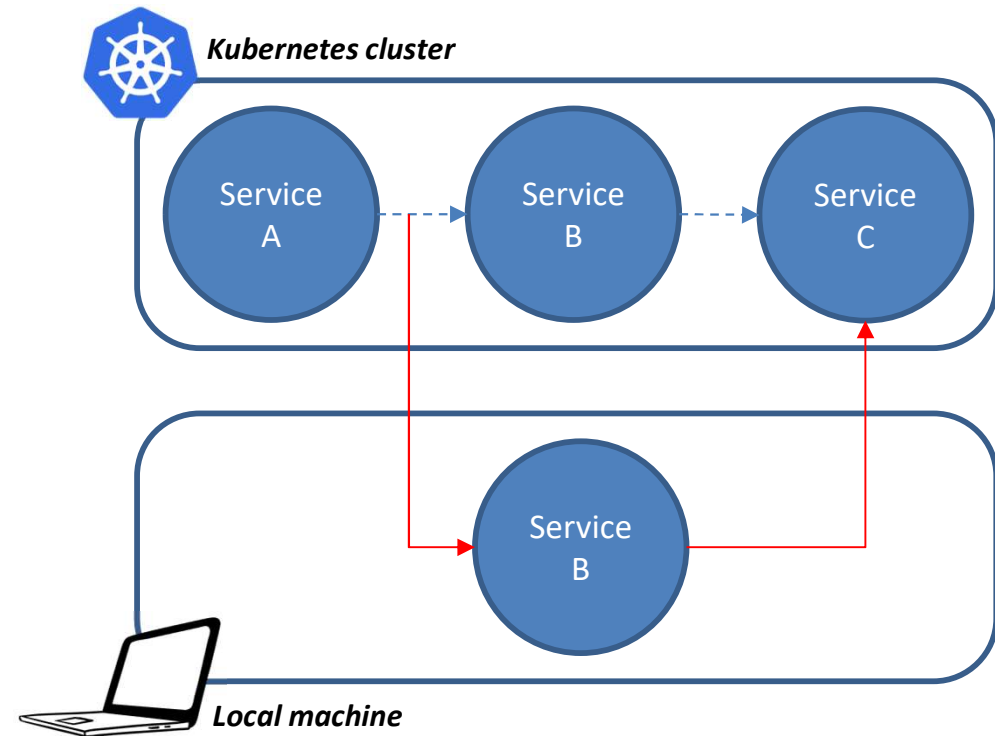


- **Approach 1:**

- develop locally + run remotely
- *sync* with remote app

- **Approach 2:**

- develop + run locally
- *route* remote traffic to local app



# Remocal workflow



Belastingdienst



- *Remocal* development tools
  - OpenShift Do (odo)
  - OpenShift Dev Spaces
  - Skaffold
  - Telepresence
  - Draft
  - ...
  - Quarkus



odo



SKAFFOLD



# Remocal workflow



Belastingdienst

- *OpenShift do (odo)*



- *odo init / odo dev*

- Devfile registry

- Independent of runtime

- Quarkus
- Liberty
- ...

```
[user@jfall2023:~/demo]$ odo dev
[ ] Developing using the "demoservice" Devfile
[ ] Namespace: jfall_namespace
[ ] odo version: v3.1.0

↳ Deploying to the cluster in developer mode
  • Waiting for Kubernetes resources ...
  ✓ Added storage m2 to component
  △ Pod is Pending
  ✓ Pod is Running
  ✓ Syncing files into the container [542ms]
  ✓ Executing init-compile command [23s]
  • Executing the application (command: dev-run) ...

  - Forwarding from 127.0.0.1:40001 -> 8080
  - Forwarding from 127.0.0.1:40002 -> 5858

↳ Dev mode
  Status:
  Watching for changes in the current directory

Keyboard Commands:
[Ctrl+c] - Exit and delete resources from the cluster
[p] - Manually apply local changes to the application on the cluster
```



# Remocal workflow



Belastingdienst

- *OpenShift do (odo)*



- No need to create YAML files!

Automatic port forwarding ←

dev mode! ←

```
[user@jfall2023:~/demo]$ odo dev

Developing using the "demoservice" Devfile
Namespace: jfall_namespace
odo version: v3.1.0

↳ Deploying to the cluster in developer mode
  • Waiting for Kubernetes resources ...
  ✓ Added storage m2 to component
  △ Pod is Pending
  ✓ Pod is Running
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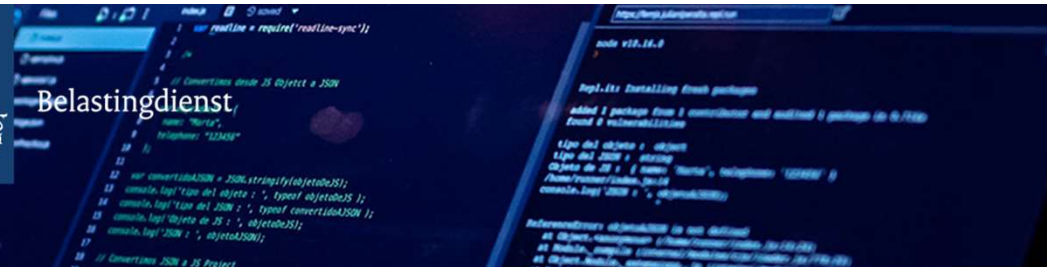
↳ Dev mode
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```

# Remocal workflow

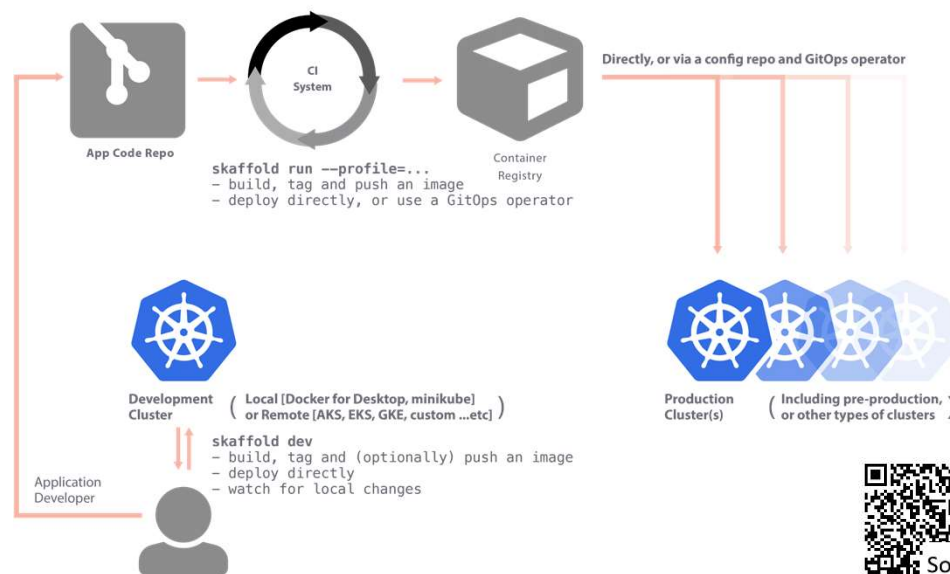


Belastingdienst



- *Skaffold* is a *client-side* CI/CD tool
- Automatically build, test and deploy
  - local or remote
- Create Kubernetes manifests (YAMLs) with *Dekorator*

```
[user@jfall2023:~/demo]$ skaffold init
[user@jfall2023:~/demo]$ skaffold dev
```




# Remocal workflow

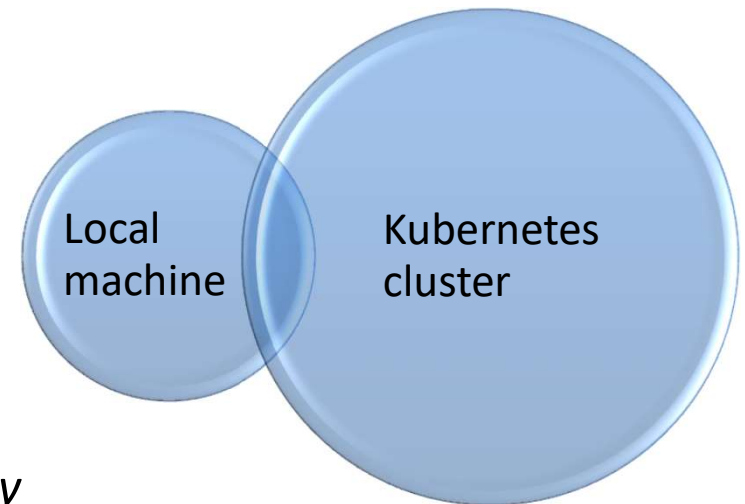


Belastingdienst



A1

- *Telepresence* 
- Let your local developer machine act as part of the remote cluster
- Often used together with skaffold (or any other 'dev mode' tool)
  - Skaffold : *build + deploy locally*
  - Telepresence : *test*



**Dia 43**

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**A1**

Auteur; 23-10-2023

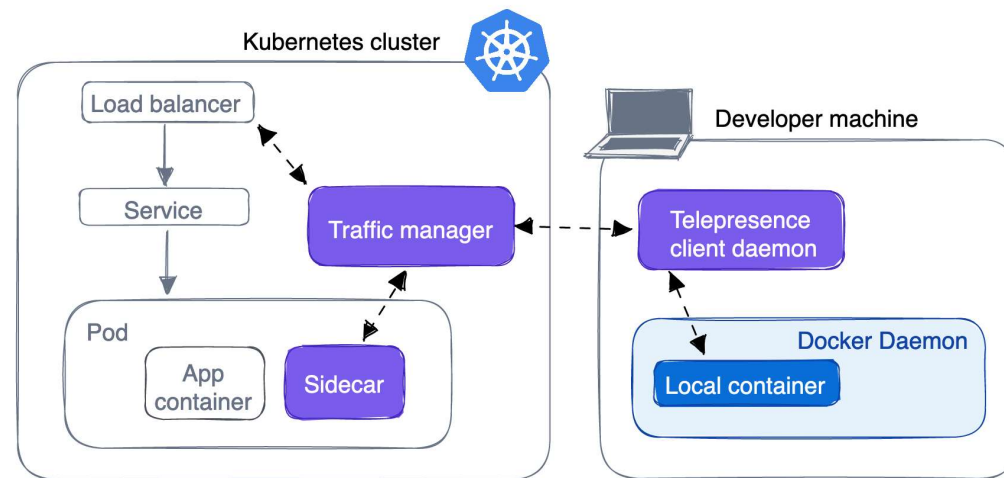
# Remocal workflow



Belastingdienst



- *Telepresence* provides two components:
  - *Cluster-side* traffic manager
  - *Local* traffic agent
- Call remote microservices from your local machine
- Route remote traffic to your local application



```
[user@jfall2023:~/demo]$ telepresence connect  
  
[user@jfall2023:~/demo]$ telepresence intercept demo-service --port 8080:8080
```



Source

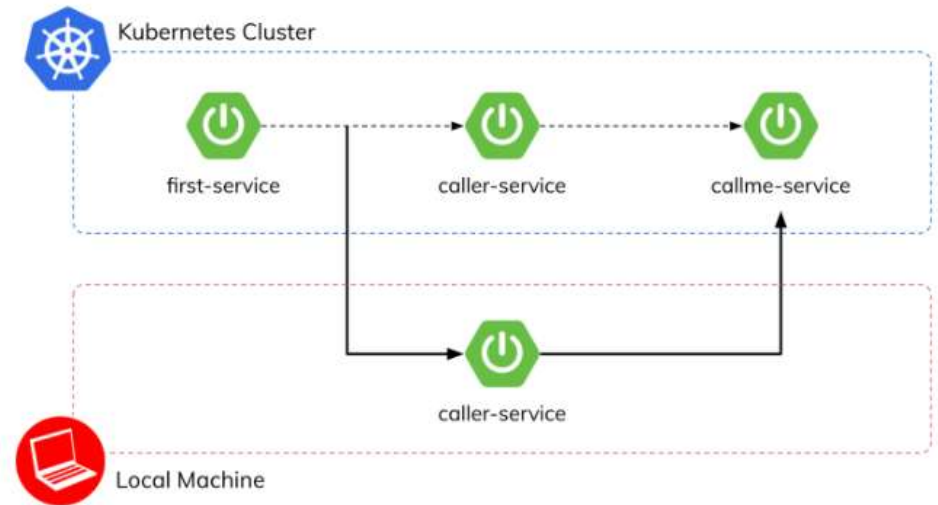
# Remocal workflow



Belastingdienst

```
var readline = require('readline-sync');  
  
// Conviertes desde JS Objeto a JSON  
const 'Marta',  
      telephone: '123456'  
};  
  
11 |  
12 |  
13 | var convertidoJSON = JSON.stringify(objetoJS);  
14 | console.log('tipo del objeto : ', typeof objetoJS );  
15 | console.log('tipo del JSON : ', typeof convertidoJSON );  
16 | console.log('Objeto de JS : ', objetoJS);  
17 | console.log('JSON : ', convertidoJSON);  
18 |  
19 | // Conviertes JSON a JS Project
```

- *Telepresence* intercepts a call to the remote running microservice
- Call will be routed to the microservice running locally
- Local microservice is able to call remote running microservices





Belastingdienst

# Quarkus



# Quarkus



Belastingdienst

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var readline = require('readline-sync');  
  
// Converteer oude JS object a JSON  
naam: "Marta",  
telefoon: "12345"  
  
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```

- *Kubernetes-native* Java development stack
- *Build on standards*
  - *MicroProfile*
  - *Jakarta*





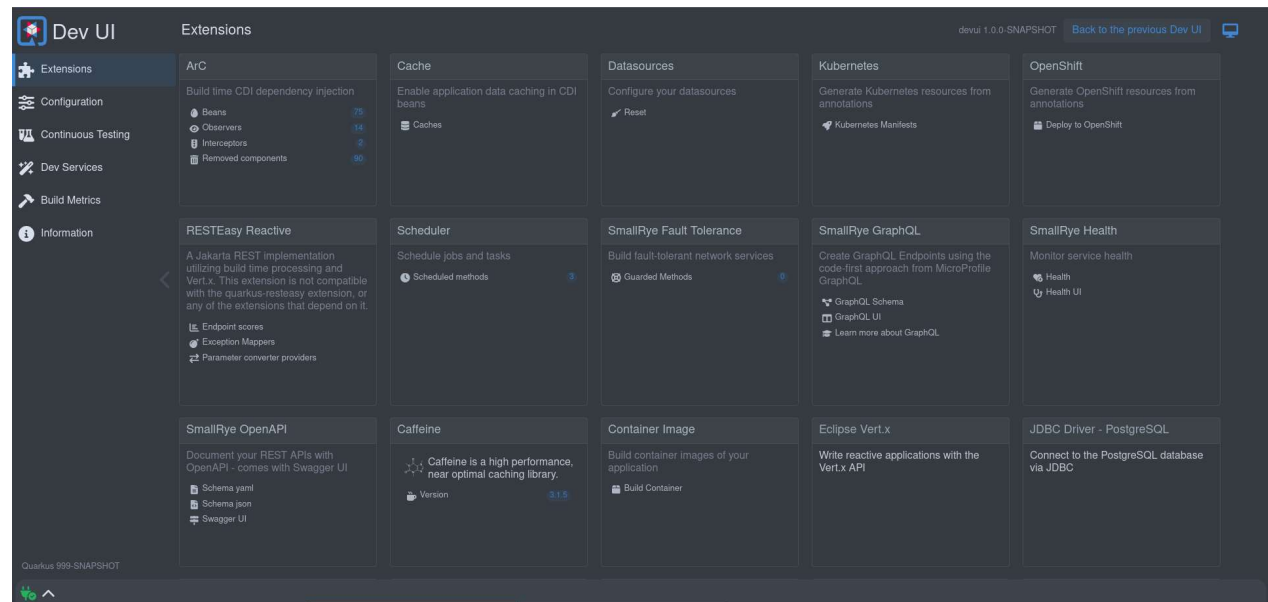
# Quarkus



Belastingdienst



- Quarkus *dev* mode
- Continuous testing
- Dev UI
- Quarkus *remote-dev* mode



# Quarkus



Belastingdienst



- Dev services
  - Based on *testcontainers*
- Fully automatic!
  - No need to add testcontainer libraries manually
  - No manual integration
  - No configuration
  - No code



# Quarkus



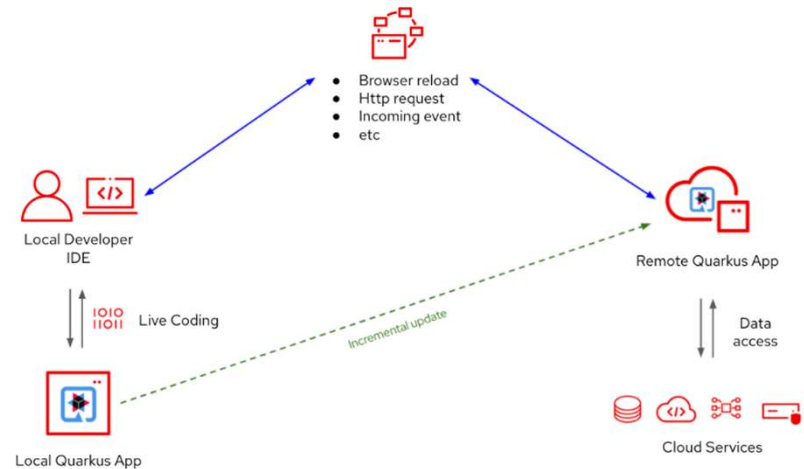
Belastingdienst



- *Quarkus Remote Development*
- Create *mutable* JAR

```
quarkus.package.type=mutable-jar 1  
quarkus.live-reload.password=changeit 2  
quarkus.live-reload.url=http://my.cluster.host.com:8080 3
```

```
[user@jfall2023:~/demo]$ ./mvnw quarkus:remote-dev
```



Source

# Quarkus



Belastingdienst



- *Quarkus* : *build + deploy locally*
- *JKube* : *test*



QUARKUS

+



**JKube**





- *Eclipse Jkube Remote Development*

Definition local microservices

Definition remote microservices

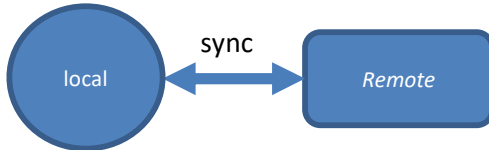
```
<plugin>
  <groupId>org.eclipse.jkube</groupId>
  <artifactId>openshift-maven-plugin</artifactId>
  <version>1.14.0</version>
  <configuration>
    <remoteDevelopment>
      <localServices>
        <localService>
          <serviceName>service-B</serviceName>
          <port>8082</port>
        </localService>
      </localServices>
      <remoteServices>
        <remoteService>
          <hostname>service-A</hostname>
          <port>80</port>
          <localPort>8083</localPort>
        </remoteService>
        <remoteService>
          <hostname>service-C</hostname>
          <port>80</port>
          <localPort>8084</localPort>
        </remoteService>
      </remoteServices>
    </remoteDevelopment>
  </configuration>
</plugin>
```

```
[user@jfall2023:~/demo]$ ./mvnw oc:remote-dev
```

# Summary



Belastingdienst

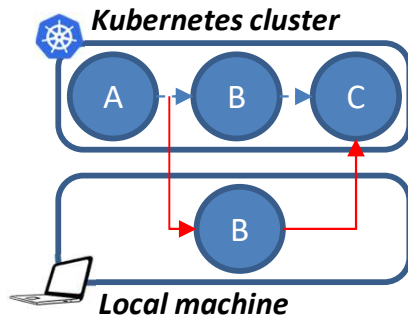


*Sync approach*

Odo

Skaffold

Quarkus remote development



*Route approach*

Skaffold + Telepresence

Quarkus + JKube