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Container Native Development Tools Compared: Draft, Skaffold, and Tilt

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#OracleCloudNative
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Who am I?

Mickey Boxell

Cloud Advocate, etc.

Oracle Cloud Native Labs

Share best practices and build original solutions and content for Oracle Cloud developers with a key focus on cloud native/container native, open source, and DevOps

http://cloudnative.oracle.com/

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Microservice Environments

- Distributed
- Container-based
- Polyglot
- Highly-scalable
- Ephemeral

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Development Workflow

- Step 1: Write code
- Step 2: Build code
- Step 3: Run code
- Step 4: Identify issues and return to Step 1

Container Native Development Workflow

- Step 1: Write code
- Step 2: Build code

Step 2.1: Build a container image

Step 2.2: Push the image to a registry

- Step 3: ~~Run code~~ Deploy to Kubernetes cluster
- Step 4: Identify issues and return to Step 1

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Traditional Deployment: Helidon/Java

```
$ mvn archetype:generate -DinteractiveMode=false \
        -DarchetypeGroupId=io.helidon.archetypes \
        -DarchetypeArtifactId=helidon-quickstart-se \
        -DarchetypeVersion=1.1.1 \
        -DgroupId=io.helidon.examples \
        -DartifactId=helidon-quickstart-se \
```

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Traditional Deployment: Helidon/Java

```
$ cd helidon-quickstart-se

$ mvn package

$ java -jar target/helidon-quickstart-se.jar
```

Container Native Deployment: Helidon/Java

```
$ docker build -t helidon-quickstart-se .

$ docker run --rm -p 8080:8080 helidon-quickstart-se:latest
```

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Local Kubernetes Cluster Deployment: Helidon/Java

```
$ kubectl apply -f app.yaml
```

Remote Kubernetes Cluster Deployment: Helidon/Java

```
$ docker tag \ helidon-quickstart-se:latest \ <region-code>.ocir.io/<tenancy-name>/<repo-name>/<image-name>:<tag>
$ docker push \ <region-code>.ocir.io/<tenancy-name>/<repo-name>/<image-name>:<tag>
$ kubectl apply -f app.yaml*
```

* modified with a container image matching the registry

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The Whole Flow

Step 1: Write code

Step 2: Build code AND build the image AND push the image to a registry

```
$ mvn package
$ docker build -t helidon-quickstart-se .
$ docker tag \ helidon-quickstart-se:latest \ <region-code>.ocir.io/<tenancy-name>/<repo-name>/<image-name>:<tag>
$ docker push \ <region-code>.ocir.io/<tenancy-name>/<repo-name>/<image-name>:<tag>
```

Step 3: Deploy to Kubernetes Cluster

```
$ kubectl apply -f app.yaml
```

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That seems like a lot of typing

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Of the same set of commands

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Over and over

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Why Did I Care?

- Simple code changes took too much time & too many keystrokes
- e.g. Was my endpoint zipkin.monitoring:9411 or 10.0.32.4:9411/zipkin or something else?
- Each change required me to: build code, build image, tag image, push image, apply manifest

When Does This Take Place?

- The inner loop of the container native development workflow: the period of time during which you are writing code, but have not yet pushed it to a version control system
- More simply: “when you’re iterating on code pre-commit”

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Why Deploy To A Cluster?

- Run integration and dependency tests
- Run diagnostic tools – logging, tracing, etc.

Why Deploy To A Remote Cluster?

- Match test environment to production environment
- Compliance – not everyone has access to a local cluster

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There’s even more going on under the covers

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Dockerfile

```
# 1st stage, build the app
FROM maven:3.5.4-jdk-9 as build
WORKDIR /helidon
# Create a first layer to cache the "Maven World" in the local
repository. Incremental docker builds will always resume after
that, unless you update the pom
ADD pom.xml .
RUN mvn package –DskipTests
# Do the Maven build! Incremental docker builds will resume here
when you change sources
ADD src src
RUN mvn package –DskipTests
RUN echo "done!”
```

```
# 2nd stage, build the runtime image
FROM openjdk:8-jre-slimWORKDIR /helidon
# Copy the binary built in the 1st stage
COPY --from=build /helidon/target/helidon-quickstart-se.jar ./
COPY --from=build /helidon/target/libs ./libsCMD ["java", "-jar",
"helidon-quickstart-se.jar"]
```

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Build, Push, Deploy Tools

What Are These Tools?

- Draft by Microsoft Azure
- Skaffold by Google
- Tilt by Windmill Engineering

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What Do These Tools Do?

- Build code
- Build an image of your project
- Push the image to a registry service of your choice
- Deploy the image onto a Kubernetes cluster
- And they are all open source

Pre-Requisites

- Docker
- A Kubernetes cluster
  - Docker For Desktop/Minikube
  - Oracle Container Engine for Kubernetes (OKE)
- Kubectl
- An image registry service
  - Oracle Cloud Infrastructure Registry (OCIR)

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Sample Application

helidon.io

- Helidon Framework
  - Java libraries for writing microservices
- Quickstart-SE sample application

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Draft

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Draft

- Low barrier to entry: Draft packs
    - draft create: boilerplate artifacts to run existing apps in K8s
- Uses Helm

Using Draft

Pre-Reqs: Docker, Kubectl, Helm

- draft init – install packs/plugins and configure $DRAFT_HOME
- draft create – create boilerplate based on application language
- draft config set registry phx.ocir.io/oracle-cloudnative/draft - creates .draft file
- docker login
- draft up + draft delete - make registry public or use imagepullsecrets

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Using Draft

- Port forward: draft connect
- Logs: draft logs

Draft

- Boilerplate is helpful to get started
- No watch/continuous deployment feature
- Helm can be overly-complicated
    - Didn’t use the ports set in app.yaml because of the Helm chart/values.yaml

Skaffold

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Skaffold

Flexible

- Many build options (Dockerfile locally, Dockerfile in-cluster with Kaniko, Dockerfile on the cloud, Jib Maven/Gradle locally, etc.)
- Many deploy options (kubectl, Helm, Kustomize)
- Many image tag policies

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Using Skaffold

Pre-Reqs: Docker, Kubectl

- vi skaffold.yaml – specifies workflow steps
- skaffold config set default-repo phx.ocir.io/oracle-cloudnative/skaffold – creates .skaffold file
- docker login
- skaffold run + skaffold delete or skaffold dev - make registry public or use imagepullsecrets + change image spec in app.yaml

Using Skaffold

Logs: skaffold run –tail

Port-forward: automatic based on pod spec configuration

Skaffold

- Profiles feature
  - A set of settings stored in skaffold.yaml that overrides the build, test, and deploy sections of your current configuration
  - skaffold run -p [PROFILE]
- Deploy multiple microservices at once – referenced in skaffold.yaml
- Deploy once with skaffold run or continuously with skaffold dev

Tilt

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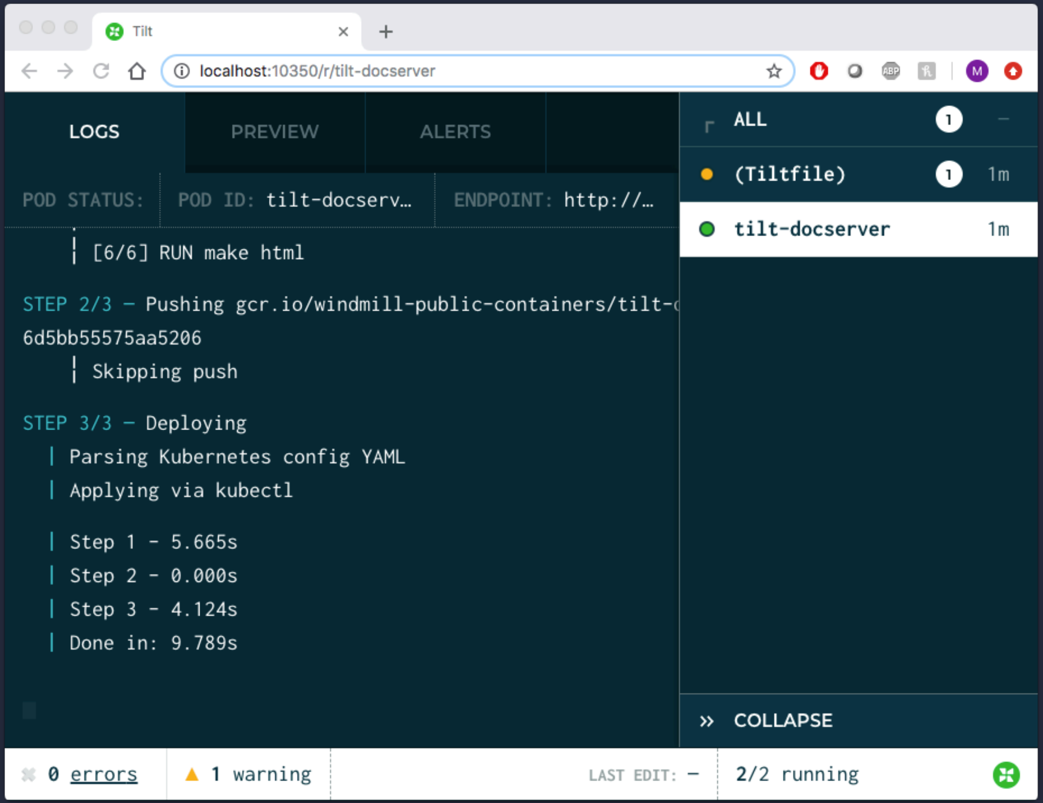
Tilt

- Heads up display and browser UI



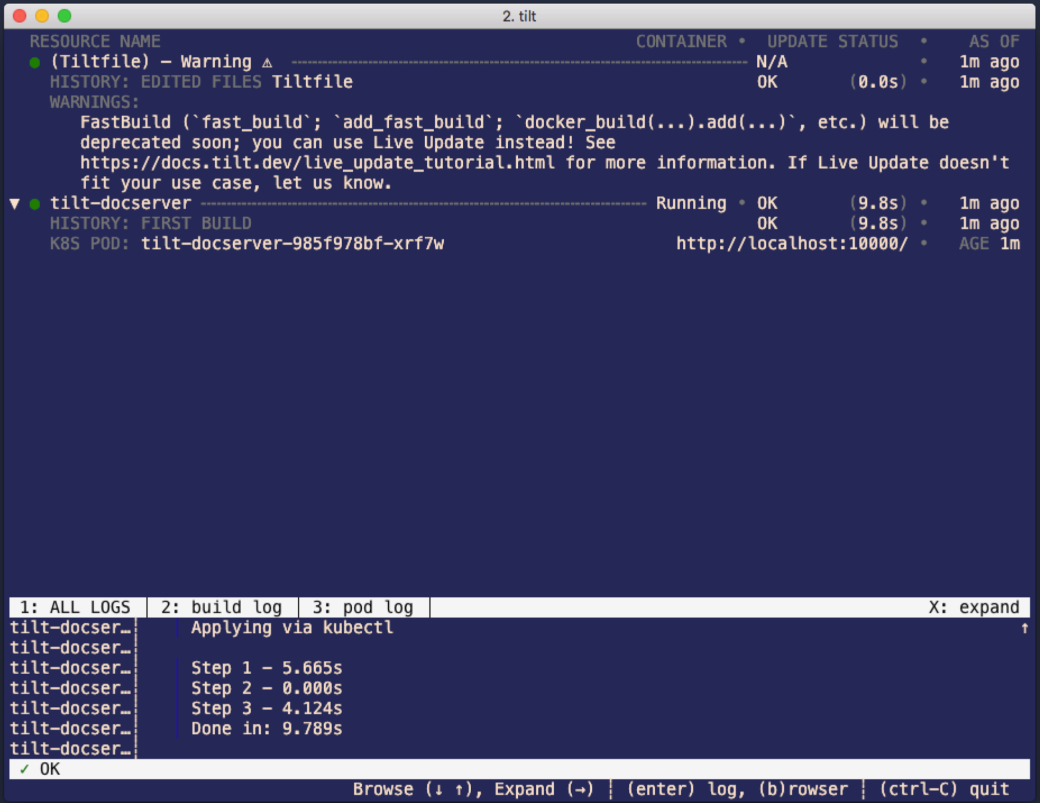
```
POD STATUS:   POD ID: tilt-docserv…   ENDPOINT: http://…
    ┆ [6/6] RUN make html

STEP 2/3 — Pushing gcr.io/windmill-public-containers/tilt-c
6d5bb55575aa5206
    ┆ Skipping push

STEP 3/3 — Deploying
  | Parsing Kubernetes config YAML
  | Applying via kubectl

  | Step 1 - 5.665s
  | Step 2 - 0.000s
  | Step 3 - 4.124s
  | Done in: 9.789s

0 errors   1 warning   LAST EDIT: —   2/2 running
```



```
2. tilt
 RESOURCE NAME                                                CONTAINER •  UPDATE STATUS  •    AS OF
 ● (Tiltfile) — Warning ⚠ ------------------------------------------- N/A                •   1m ago
   HISTORY: EDITED FILES Tiltfile                                       OK        (0.0s) •   1m ago
   WARNINGS:
      FastBuild (`fast_build`; `add_fast_build`; `docker_build(...).add(...)`, etc.) will be
      deprecated soon; you can use Live Update instead! See
      https://docs.tilt.dev/live_update_tutorial.html for more information. If Live Update doesn't
      fit your use case, let us know.
▼ ● tilt-docserver ------------------------------------------ Running • OK        (9.8s) •   1m ago
   HISTORY: FIRST BUILD                                                 OK        (9.8s) •   1m ago
   K8S POD: tilt-docserver-985f978bf-xrf7w                   http://localhost:10000/ •   AGE 1m

 1: ALL LOGS │ 2: build log │ 3: pod log │                                                X: expand
tilt-docser…┆    │ Applying via kubectl                                                          ↑
tilt-docser…┆
tilt-docser…┆    │ Step 1 — 5.665s
tilt-docser…┆    │ Step 2 — 0.000s
tilt-docser…┆    │ Step 3 — 4.124s
tilt-docser…┆    │ Done in: 9.789s
tilt-docser…┆
 ✓ OK
                           Browse (↓ ↑), Expand (→) ┆ (enter) log, (b)rowser ┆ (ctrl-C) quit
```

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Using Tilt

Pre-Reqs: Docker, Kubectl

- vi Tiltfile – specifies workflow steps
- Set registry in the Tiltfile or tilt_option.json
- docker login
- tilt up + tilt down - make registry public or use imagepullsecrets + change image spec in app.yaml

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Using Tilt

- B opens a port forward based on Tiltfile resource URL
  - Browser UI includes resource preview page
- Logs available on the UI – X to expand logs

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Tilt

- Heads up display and browser UI
- Support for Helm
- LiveUpdate: update a running container in place
  - Instead of building a new image and redeploying from scratch
- Deploys multiple microservices - sample application “servantes”
- No single deploy option

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Differentiators

DRAFT

SKAFFOLD

TILT

- Getting started boilerplate
- Flexibility
- Heads up display

Key Takeaways

- These tools automate away countless manual steps
- These tools can deploy to both local and remote clusters
  - The registry step can be bypassed for local clusters
- Useful as a step before pushing to source control and/or CI

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