

OpenShift Developer

Architecture Workshop

Application Packaging



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Self introduction

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Base: Germany (very close to the Alps)

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Experience: Years of Consulting, Training,
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Agenda / etc.

Agenda

- Application Packaging with OpenShift
 - Basics
 - OpenShift Templates
 - kustomize.io
 - Helm Charts
 - Operators
 - Summary
- Demo

Packaging Basics



What

- Now I have coded and my app works on my Kubernetes cluster
 - All fine
 - All done
- But wait...
- How to move those things from DEV to Test?
- How to release my software?
- (No, it's not just one image)
 - Deployment / DeploymentConfig
 - Service
 - PVCs
 - ConfigMaps
 - Route



What

- How to automatically recreate your App with all resources and dependencies?
- Once you've created your App with all necessary resources, you need to somehow find a way to sync it with your stages (DEV/TEST/PRE-PROD...)
- How to redistribute your App?



Zip?
Tar?
Rsync?
Binaries?
Configuration?
Templates?
Helm Charts?
Operators?
DIY?
Kustomize?

Beer!



OpenShift Templates

What

- OpenShift Templates has been the first approach in OpenShift to make your project exportable and importable
 - All the RedHat middleware products were being used via templates
 - All Samples are still coming via templates
- Helm was too basic
- Helm required Tiller (a component which required root etc.)
- Operators did not exist
- It is basically a “oc get is,bc,build,dc,is,rc,route,service -o yaml > test.yaml”
 - With some editing
 - With QUITE some editing

Can I use it?

- Short answer: Of course!
- Longer answer: If you know that you are only using OpenShift inside your own Company then please use it.
 - A Template can configure even OpenShift specific types like BuildConfigs, ImageStreams, DeploymentConfigs...
 - Easily parametrized
 - With “oc process ...” there is an easy way to process a template
 - Can easily being used in your CI/CD pipelines
 - Can be versioned
 - Not too complex
 - Proven to work, easily understandable

Szenarios to use Templates

- In-Cluster movements (DEV → TEST)
- Cross-Cluster movements (TEST → PREPROD → PROD)
- Templating Application setups, including BC for use by others
- Building special examples as templates could be consumed via UI by developers
- Distributing your Apps

Drawbacks?

- Templates are OpenShift specific
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- (And a template file could become VERY large as it contains ALL kubernetes yaml's required to run the app)

Template DEMO

kustomize.io

What

- Kustomize is a project originally founded Google
- It's in "kubectl apply -k" and "oc apply -k" now
- Has its own CLI interface, called kustomize
- It's NOT templating
- It's using overlays and patching

```
$ tree
.
├── base
│   ├── configMap.yaml
│   ├── deployment.yaml
│   ├── kustomization.yaml
│   ├── route.yaml
│   └── service.yaml
└── overlays
    ├── production
    │   ├── deployment.yaml
    │   └── kustomization.yaml
    └── staging
        ├── kustomization.yaml
        ├── map.yaml
        └── route.yaml
```

How it works

kustomization.yaml contains information about what to do and how

```
$ cat base/kustomization.yaml
apiVersion: kustomize.config.k8s.io/v1beta1
kind: Kustomization
metadata:
  name: arbitrary

# Example configuration for the webserver
# at https://github.com/monopole/hello
commonLabels:
  app: my-hello
  org: acmeCorporation

resources:
- deployment.yaml
- service.yaml
- configMap.yaml
- route.yaml
```

```
$ cat overlays/staging/kustomization.yaml
namePrefix: staging-
commonLabels:
  variant: staging
commonAnnotations:
  note: Hello, I am staging!
bases:
- ../../base
patchesStrategicMerge:
- map.yaml
- route.yaml
```

```
$ cat overlays/production/kustomization.yaml
namePrefix: production-
commonLabels:
  variant: production
commonAnnotations:
  note: Hello, I am production!
bases:
- ../../base
patchesStrategicMerge:
- deployment.yaml
- route.yaml
```

How it works

kustomize build or oc/kubectl apply -k does handle everything for you

```
$ kustomize build base
---
apiVersion: v1
kind: Service
metadata:
  labels:
    app: my-hello
    org: acmeCorporation
  name: the-service
spec:
  ports:
  - port: 8666
    protocol: TCP
    targetPort: 8080
  selector:
    app: my-hello
    deployment: hello
    org: acmeCorporation
  type: LoadBalancer
---
```

```
$ kustomize build overlays/staging
---
apiVersion: v1
kind: Service
metadata:
  annotations:
    note: Hello, I am staging!
  labels:
    app: my-hello
    org: acmeCorporation
    variant: staging
  name: staging-the-service
spec:
  ports:
  - port: 8666
    protocol: TCP
    targetPort: 8080
  selector:
    app: my-hello
    deployment: hello
    org: acmeCorporation
    variant: staging
  type: LoadBalancer
---
```

Can I use it?

- Short answer: Of course!
- Longer answer: If you're looking for a solution that integrates nicely with GitOps, you should definitely have a look
 - Kustomize can also configure OpenShift specific types like Routes etc.
 - It does NOT use parameters
 - With kustomize CLI there is a nice way to test your layers
 - Can easily being used in your CI/CD pipelines
 - Can be versioned
 - Not too complex
 - Proven to work, easily understandable

Scenarios to use kustomize

- In-Cluster movements (DEV → TEST)
- Cross-Cluster movements (TEST → PREPROD → PROD)
- GitOps
- OpenShift Pipelines / Tekton
- NOT usable for application publishing / distribution

Drawbacks?

- You can only change existing entries and add new ones...
- You can't use it for redistribution

Resources

[Automated Application Packaging and Distribution with OpenShift - Part 1/2 – Open Sourcerers](#)

<https://kustomize.io>

<https://github.com/kubernetes-sigs/kustomize>

<https://speakerdeck.com/spesnova/introduction-to-kustomize>

<https://github.com/wpernath/kustomize-demo>

Kustomize-DEMO

Helm Charts

What

- Helm originally invented 2015 and introduced later that year at KubeCon
- Helm moved as Kubernetes subproject in 2016 as Helm 2.0
- Helm 3.x is now (since 2020) an official CNCF project
- Helm is THE package manager for Kubernetes Applications
 - Helm is like RPM / APT for Linux
 - Or maven / npm for Java / node.js
- Helm Charts can easily be created, installed into a Kubernetes Cluster and also being upgraded
- With the [Artifact Hub](#) you have a huge repository of available community driven and maintained charts for every need

Can I use it?

- Short answer: Of course, but mainly for distributing your app!
- Longer answer: If you have an app release and you have to make it available for others, create a Helm Chart for it and make it easy for your customers (regardless of internal or external) to consume it
 - If you are just looking for a way to move your app from one stage to the other, have a look at Templates or kustomize.io
 - Helm and ArtifactHub are a great resource to look at for components you might need

Szenarios to use Helm Charts

- Well used for distribution of Applications
- Internal distribution & external
- Not so great for use within CI/CD (but possible, of course)

Drawbacks?

- Learning curve of Helm Charts is steep at the beginning
- It adds another complexity to your app development cycle
- Client is a templating engine with its own DSL and complexity
- Helm is intended for Day-1 Operations
- Helm is intended for stateless application distribution

Helm 2 vs 3

- Helm 2 required a server component called Tiller
 - Another app on top of kubernetes which had to be managed and maintained
 - Tiller had its own RBAC and its own audit trail
 - Tiller was storing sensitive data in ConfigMaps
 - → Loss of visibility
- Helm 3 does not need a server side component
 - It uses native kubernetes approach and only a client side tool
- **⇒ This is the reason why OpenShift did not natively support Helm prior V3**

Resources

- [Helm.sh](#)
- [Spotlight on Helm](#)
- [To Helm or not?. Helm is becoming a very popular tool to... | by Stepan | FAUN](#)
- [From Templates to Openshift Helm Charts](#)
- [Working with Helm charts using the Developer perspective - Application life cycle management | Applications | OpenShift Container Platform 4.6](#)
- [How to make a Helm chart in 10 minutes](#)
- [Artifact Hub](#)
- <https://github.com/wpernath/helm-demo.git>
- [Automated Application Packaging And Distribution with OpenShift - Part 2/3 – Open Sourcerers](#)

Helm DEMO

Operators

What

- Operators were originally invented 2018 by coreos as a way to extend kubernetes by adding new custom resources and controllers or to help human operators to operate and manage stateful applications on kubernetes
- Operators are part of the kubernetes project
- Operators are like Helm Charts a way to distribute your app
- Operators contain all the domain logic required to manage the app
 - It understands how to scale up / down a stateful app
 - It understands how to do backups
- Operators are packaged as a mix of yaml definitions and a standard language like Go, Java etc.
- OperatorHub.io contains a nice set of available operators
- OperatorSDK helps you to create an own operator

Wait... stateless / stateful?

- Stateless
 - Kubernetes can manage stateless apps easily
 - Scaling is just a matter of adding a new pod
- Stateful
 - Imagine a mysql database
 - Scaling that up, means kubernetes is creating copies of the data
 - In fact, you then would have 3 different DBs
 - You need to find a way to properly scale mysql
 - Every app handles that differently (mysql vs. postgres vs. redis)
 - That domain logic needs to be put into an Operator to automate those tasks

Can I use it?

- Short answer: Of course!
- Longer answer:
 - Whenever you need to find a way to tell kubernetes how to manage your stateful complex app, you have to use Operators.
 - If your app is stateless or does not need special treatment, don't use Operators, think about Helm Charts then

Drawbacks?

- Quite complex
- You need to understand kubernetes properly

Resources

- [OperatorHub.io | The registry for Kubernetes Operators](#)
- [Operators on Red Hat OpenShift](#)
- [Operator SDK](#)
- [An intro to Kubernetes operators](#)
- [Kubernetes Operator simply explained in 10 mins](#)

Summary

Summary

- All 4 packaging mechanisms discussed are solving mainly 2 different use cases
 - Application Distribution
 - CI/CD
- Helm Charts, Kubernetes Operators and kustomize are standardized kubernetes or CNCF projects.
- Templates are OpenShift specific
- Unfortunately, you have to think about 2 different mechanisms in a typical project
 - You need CI/CD → kustomize or Templates
 - You might need app distribution → Helm or Operator

Summary - CI/CD

- Use OpenShift Templates if
 - You're purely on OpenShift
 - You need a quick and easy way to move your apps to other stages
 - You want to create special sample apps for developers
 - You want to be included in the developer perspective to choose from
 - You don't like the approach of kustomize (patch&merge)
- Use kustomize if
 - You just want to have a standard way of doing CI/CD
 - You don't like the template approach
 - You don't know if you're staying on OpenShift
 - You want to rely on kubernetes standards

Summary - Application Distribution

- Use Helm if
 - Your app is relatively easy and straight forward
 - Your app does not require special kubernetes configs
 - Your app is mainly a stateless application
- Use Operators if
 - Your app requires special handling, special kubernetes custom resources (CRDs)
 - Is complex and requires a special backup strategy
 - Needs several Dependencies
 - Have a special need for Day 2 Operations
 - Is a stateful application
- Good: You can even create Operators out of a Helm Chart

Resources

- [Kubernetes Operators and Helm – It takes Two to Tango](#)
- [Kubernetes Operators vs. Helm Charts: Which to Use and When](#)
- [Build Kubernetes Operators from Helm Charts in 5 steps](#)
- [Automated Application Packaging and Distribution with OpenShift – Part 1/2](#)
- [Automated Application Packaging And Distribution with OpenShift - Part 2/3](#)

THANK YOU