



# Developer Experience at Zalando

---

CNCF END USER

SIG-DX

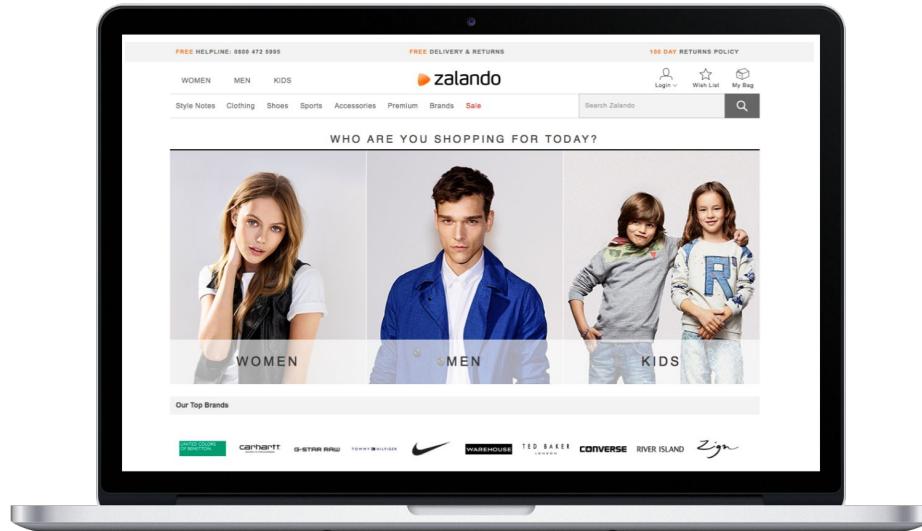
2019-04-18

HENNING JACOBS

@try\_except\_



# EUROPE'S LEADING ONLINE FASHION PLATFORM



# ZALANDO AT A GLANCE

~ **5.4** billion EUR

revenue 2018

> 15.000

employees in  
Europe

> 79%

of visits via  
mobile devices

> 250  
million

visits  
per  
month

> 26

million  
active customers

> 300.000

product choices

~ 2.000

brands

17

countries

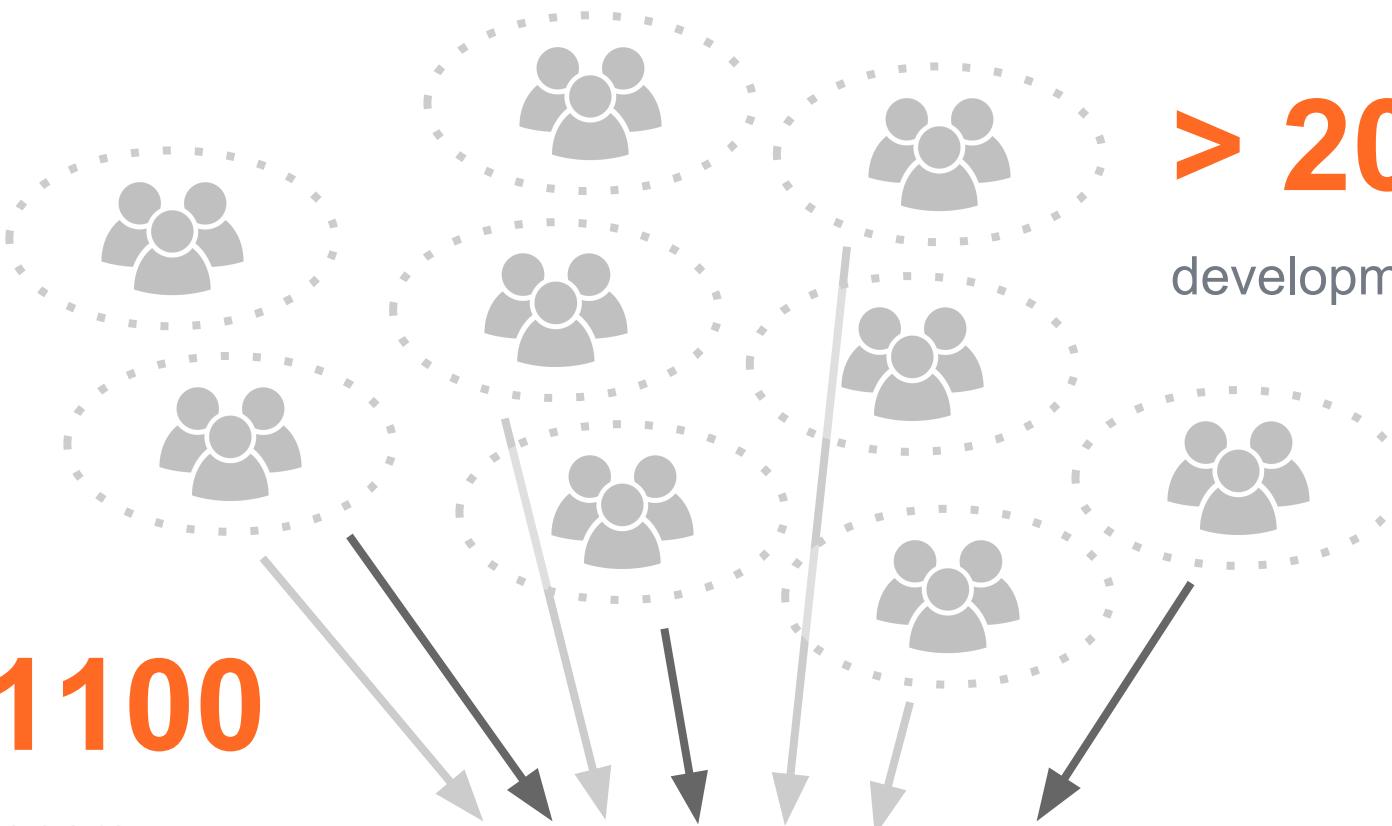
> 1100

developers

Platform

> 200

development teams



# YOU BUILD IT, YOU RUN IT

*The traditional model is that you take your software to the wall that separates development and operations, and throw it over and then forget about it. Not at Amazon.*

**You build it, you run it.** This brings developers into contact with the day-to-day operation of their software. It also brings them into day-to-day contact with the customer.

- A Conversation with Werner Vogels, ACM Queue, 2006

# ON-CALL: YOU OWN IT, YOU RUN IT



*When things are broken,  
we want people with the best  
context trying to fix things.*

- [Blake Scrivener, Netflix SRE Manager](#)

# KUBERNETES @ ZALANDO

Default  
Deployment  
Target

1400~  
nodes

Since  
Oct 2016

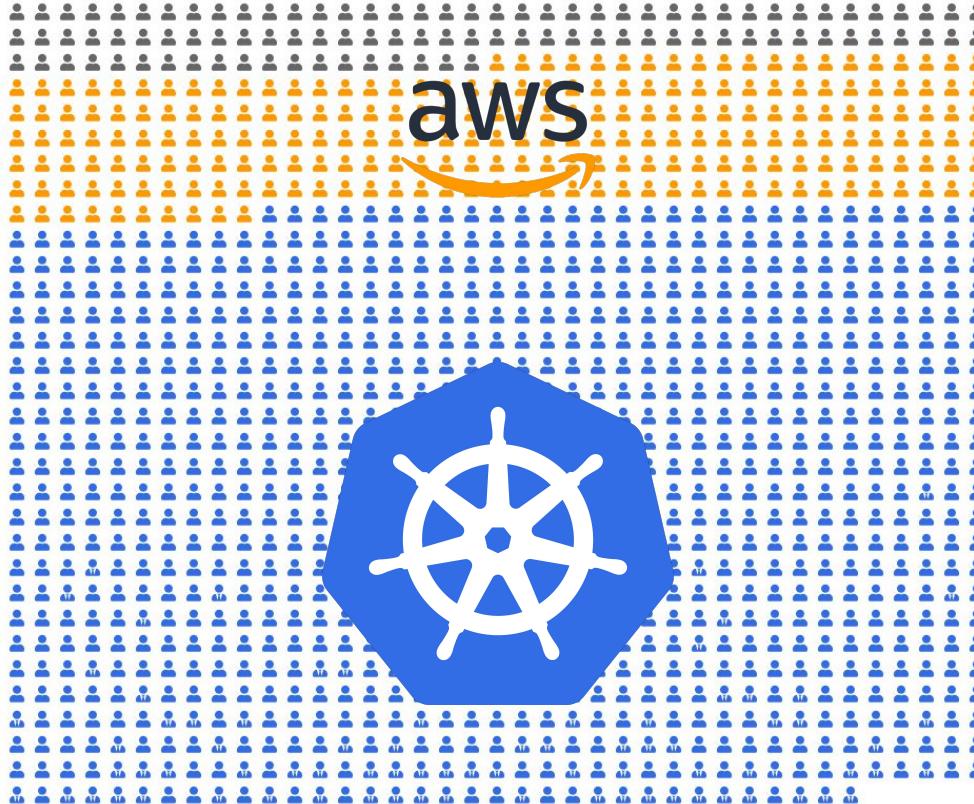
114  
clusters

Node  
Autoscaling

From v1.4  
to v1.12



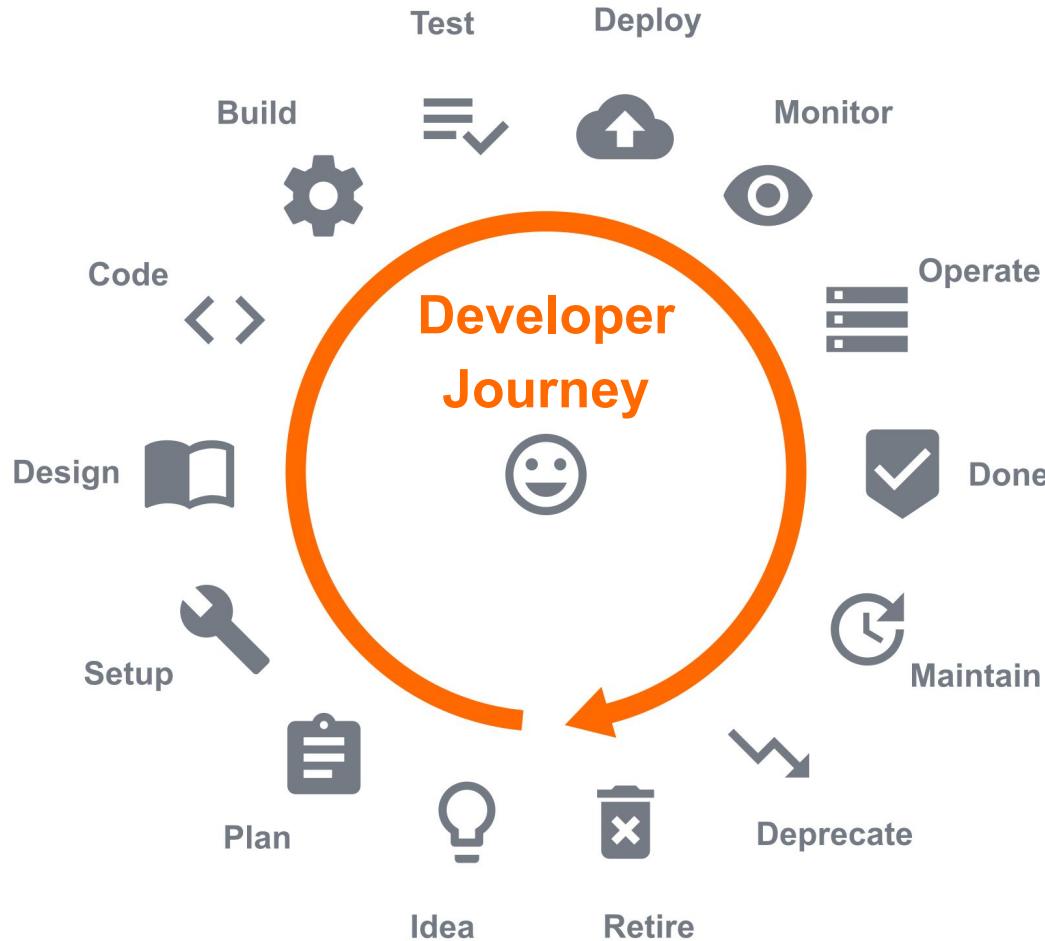
# DEVELOPERS USING KUBERNETES





## DEVELOPER JOURNEY

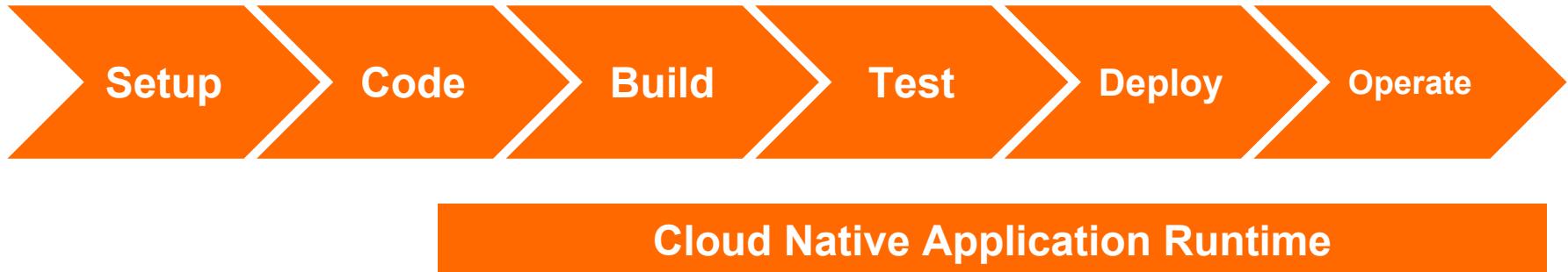
**Consistent story  
that models  
all aspects of SW dev**



**Correctness**  
**Compliance**  
**GDPR**  
**Security**  
**Cost Efficiency**  
**24x7 On Call**  
**Governance**  
**Resilience**  
**Capacity**  
...



# DEVELOPER PRODUCTIVITY



## Welcome to the Developer Journey

### APPLICATIONS

The Developer Console is your guide for all the things you need to take an application from conception to production within 30 minutes. Every application starts as an idea, which subsequently undergoes planning, design, coding and testing phases until, at the end of its lifetime, it is retired.

You will find links to documentation, tools and information for your journey in this Idea Developer Console.

We here in Developer Productivity want to support you as best we can and if something is missing, you need more information or features, do not hesitate to reach out to us by clicking on the feedback icon in the top right. Any feedback is highly appreciated.

### Design

[RESTful API Guidelines](#)

[API Portal](#)

[Zally API Linter](#)

[Fashion Content Platform \(AI & Data APIs\)](#)

### Test



Deploy



Monitor



Build



Code



Design



Setup



Plan



Idea



Operate



Done



Maintain



Deprecate



Retire



[Rules of Play](#)



[Tech Radar](#)



[Confluence](#)

[Nexus](#)

[Database as a Service](#)

[Open Source One-Stop-Shop](#)

[don't show me again](#) close

### Setup

[ZACK Role Management](#)

[GitHub Enterprise](#)

[Create Git Repository](#)

[YOUR TURN](#)

[Zappr](#)

[Create database cluster](#)

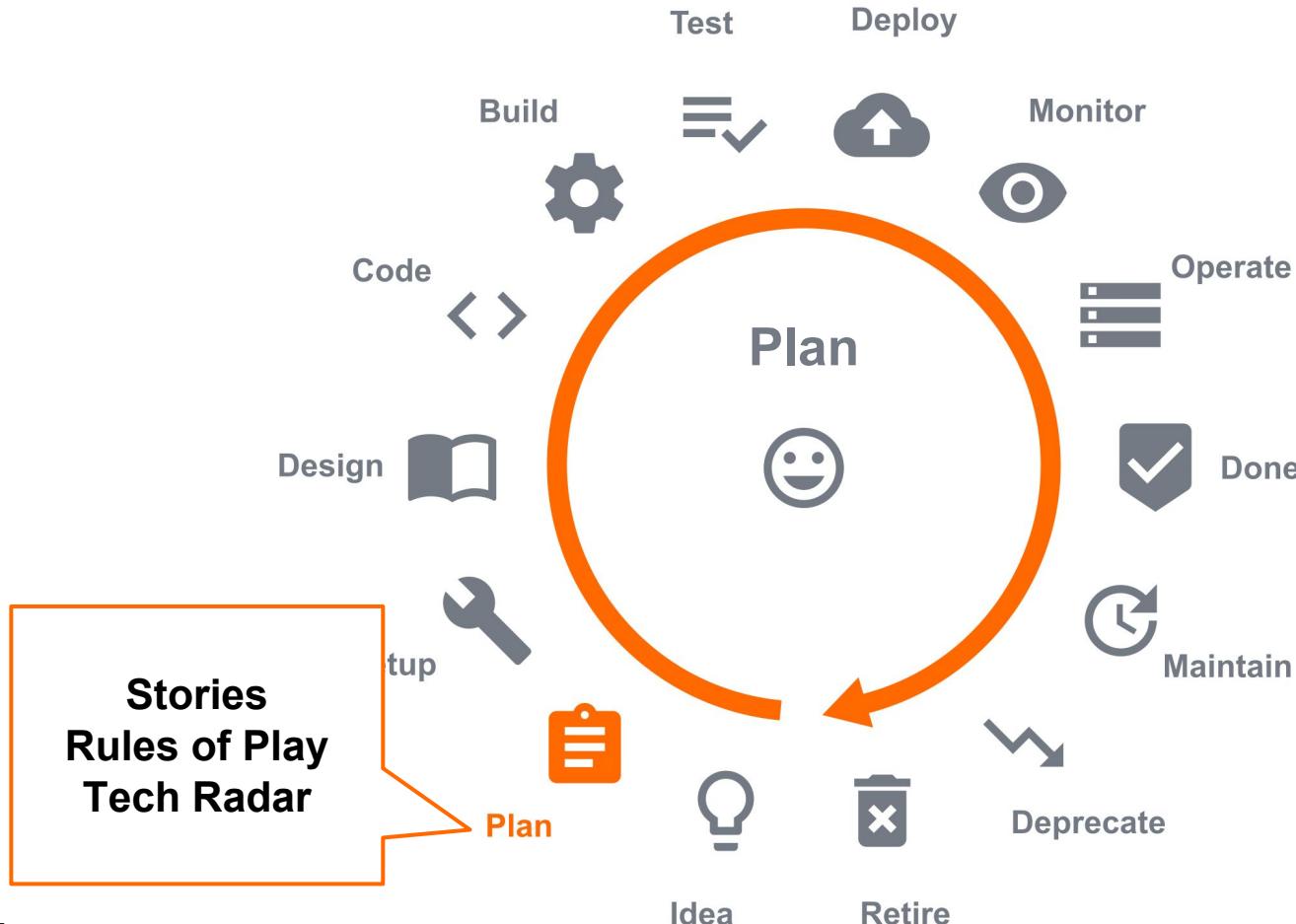
[AWS Account Chooser](#)

### Build

[Continuous Delivery Platform \(CDP\)](#)



## PLAN & SETUP



# Zalando Tech Radar — 2018.02

## Frameworks

ADOPT	ASSESS
1. Akka (Scala)	15. Akka-Http
2. Node.js	16. Aurelia
3. OpenAPI (Swagger)	17. Ember.js
4. Play (Scala)	18. gRPC
5. React.js	19. Http4s
6. RxJava (Android)	20. JOOQ
7. scikit-learn	21. Redux
8. Spring	22. Vert.x
	23. Vue.js

## TRIAL

HOLD
9. Angular
10. AspectJ
11. Camel
12. Camunda
13. OpenNLP
14. Thymeleaf
24. Activiti
25. AngularJS 1.x
26. BackboneJS
27. Drools
28. Spray

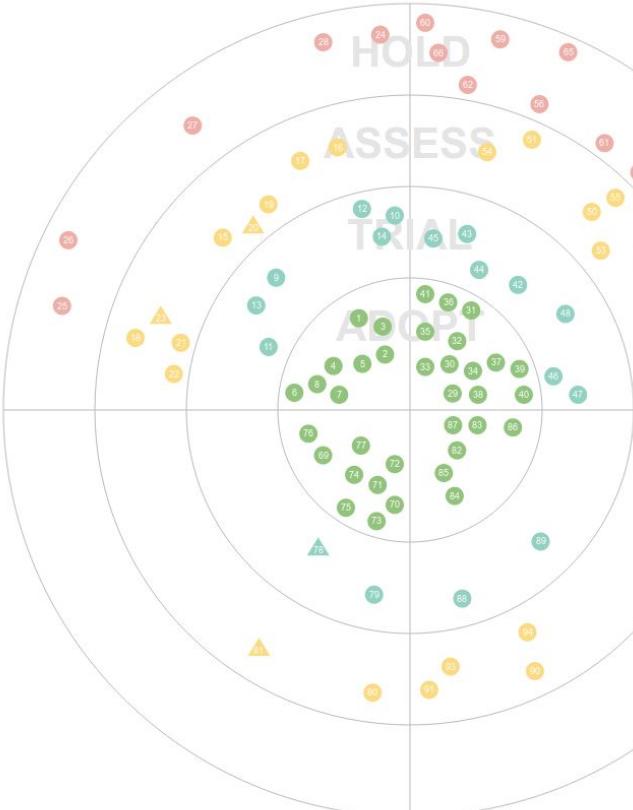
## Infrastructure

ADOPT	ASSESS
69. Docker	80. AWS Lambda
70. HAProxy	81. OpenTracing
71. Hystrix	
72. Jetty	
73. Kubernetes	
74. Nginx	
75. S3 UPS	
76. Tomcat	
77. ZMON	
	HOLD

## TRIAL

78. Failsafe
79. Undertow

▲ moved up ▼ moved down



# ZALANDO TECH RADAR

## Kotlin ASSESS

[edit this page](#)

Kotlin is a pragmatic, multi-paradigm, multi-platform, modern, safe, interoperable and toolable programming language by JetBrains. Its primary focus is and has been the JVM ecosystem.

Nonetheless, it supports compilation to [JavaScript](#) and native code via LLVM. More than just compilation, Kotlin makes sure to integrate very well with the respective ecosystem, be it package managers or build tools. Plus, for each additional feature the designers deeply think about its implications with respect to toolability, compilation performance, learning costs and multi-platform suitability. All of this is a reflection of Kotlin's philosophy: Pragmatism and interoperability over fancy but costly language features.

Kotlin was developed mostly in the open with constant feedback from the community. A handful of companies were using the language in production even before the 1.0 release. Nowadays, many companies use Kotlin in critical applications. Notable examples include: Android, Gradle, Netflix, Pinterest, Atlassian, Coursera, Evernote, Trello and Uber.

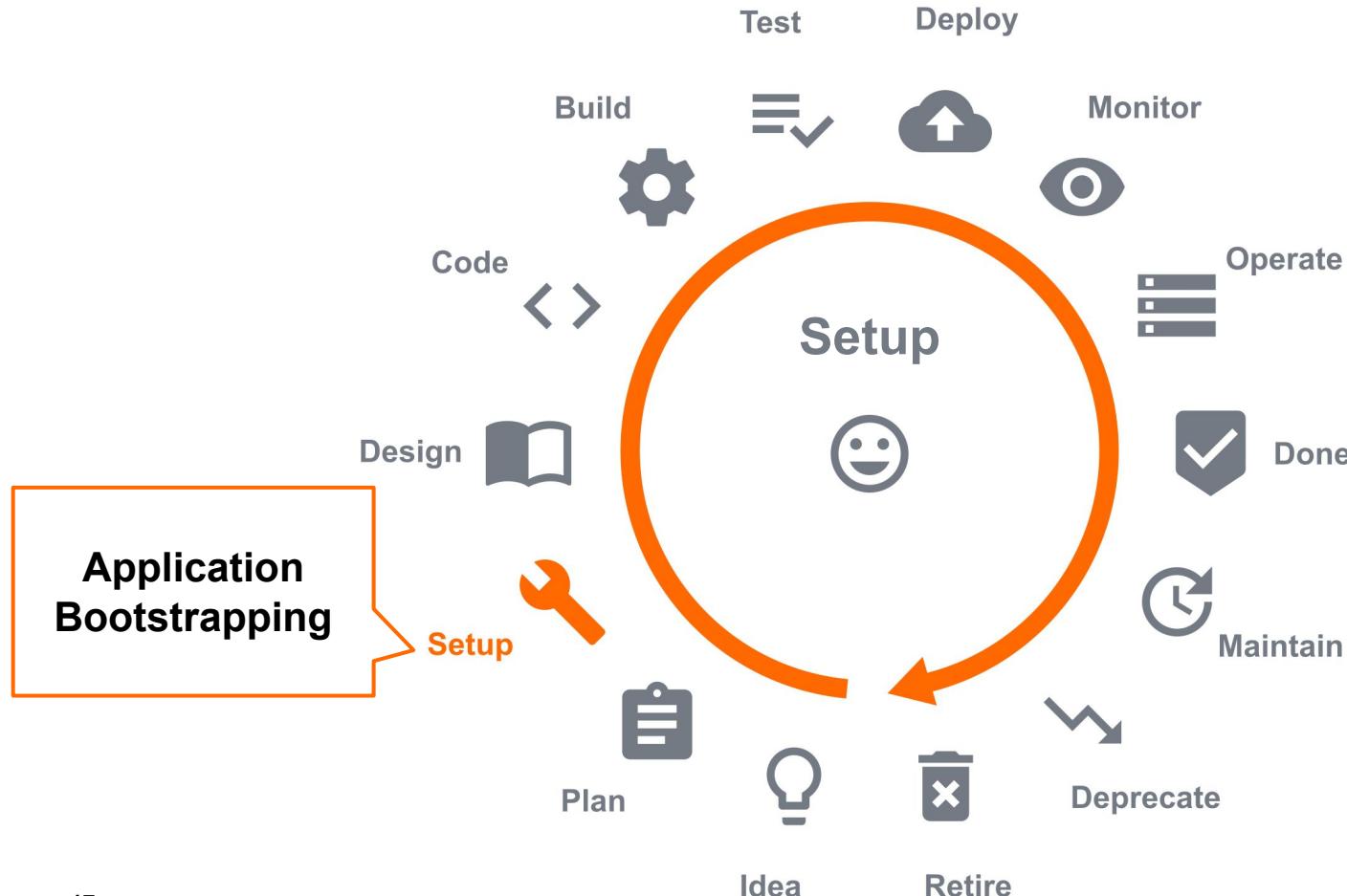
### Notable language features:

1. Nullable types — with compiler checking on dereferencing
2. Smart casts — type narrowing based on control flow
3. Extension methods — define methods on any type
  1. extend APIs with discoverable methods
4. Data classes — create POJOs easily with auto-generated equals, hashCode and toString methods
5. Properties — auto-generated properties for class fields
6. Functional programming — supports closures, (explicit) tail recursion and higher order functions

Index  
Changelog  
Common choices

Data Processing  
Datastores  
Frameworks  
Infrastructure  
Languages

- Go
- Java
- JavaScript
- Python
- Scala
- Swift
- Clojure
- TypeScript
- Elm
- Haskell
- **Kotlin**
- R
- Rust
- C languages
- CoffeeScript
- Erlang
- Groovy
- .NET languages
- Perl
- PHP
- Ruby
- GraphQL
- JRuby
- Jython



## Create a new repository

A repository contains all the files for your project, including the revision history

Organisation \*  ▼ X / Repository Name \*  X

Description

Team ID \*

Repository type \*

Code

Bootstrap with application template

web-java-spring-boot-rest

Add .gitignore template

\* Mandatory fields

Create Repository

Branch: master ▾

New pull request

Create new file

Upload files

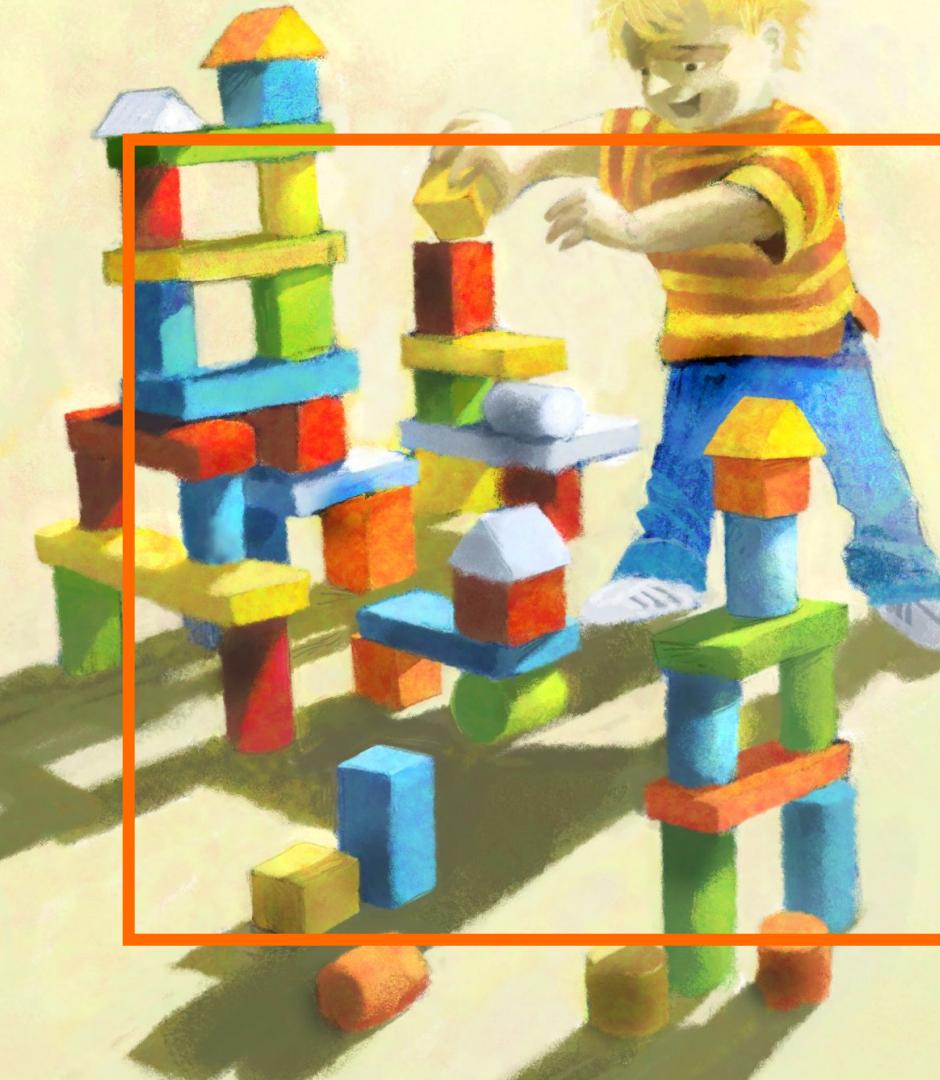
Find file

Clone or download ▾

 [REDACTED]	committed with  Updated readme due to switch to riptide (#34)	Latest commit 965218e 7 hours ago
 <a href="#">api</a>	Migrated out of twintip (#29)	20 days ago
 <a href="#">deploy/apply</a>	Remove not existing uid privilege (#7)	7 months ago
 <a href="#">gradle/wrapper</a>	Upgrade dependencies to newest versions (#16)	5 months ago
 <a href="#">src</a>	Run Docker build from project root (#33)	18 days ago
 <a href="#">.gitignore</a>	Move over to riptide (#31)	18 days ago
 <a href="#">.zappr.yaml</a>	Add match label selector (#4)	7 months ago
 <a href="#">Dockerfile</a>	Run Docker build from project root (#33)	18 days ago
 <a href="#">README.md</a>	Updated readme due to switch to riptide (#34)	7 hours ago
 <a href="#">build.gradle</a>	Move over to riptide (#31)	18 days ago
 <a href="#">configure.sh</a>	Configure script adapted to osx (#30)	18 days ago
 <a href="#">delivery.yaml</a>	Run Docker build from project root (#33)	18 days ago
 <a href="#">gradlew</a>	Upgrade dependencies to newest versions (#16)	5 months ago
 <a href="#">gradlew.bat</a>	Transition to single repo per template	7 months ago
 <a href="#">settings.gradle</a>	Use  as team to prepare for deployment (#1)	7 months ago
<hr/>  <a href="#">README.md</a>		

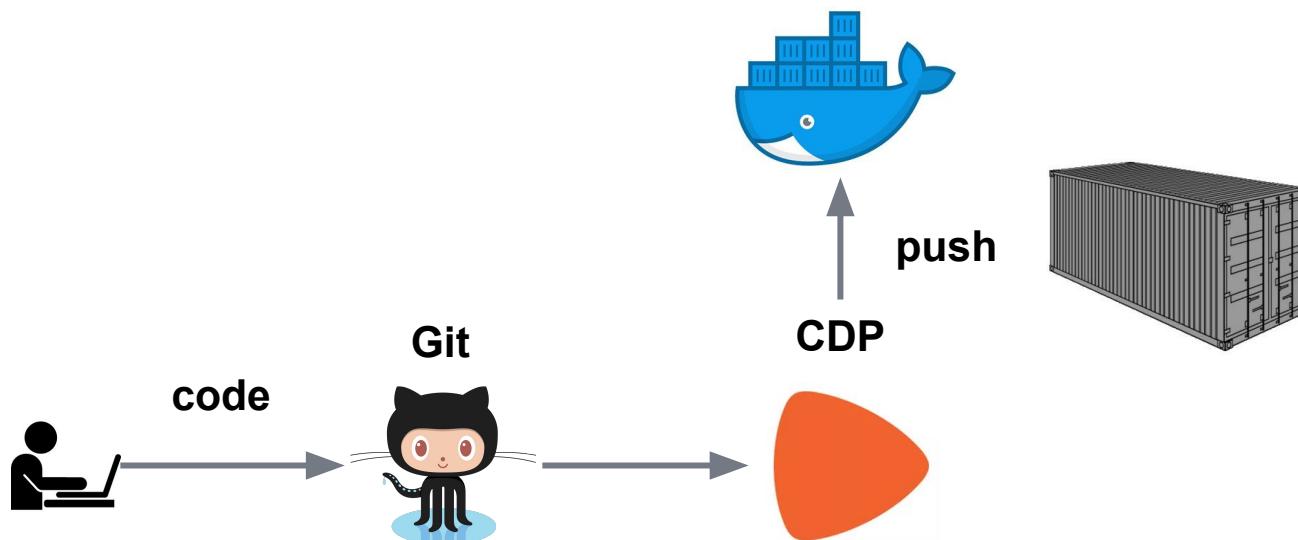
## Java - Spring Boot - REST

This project is a highly opinionated template for a Java Spring Boot based REST service. It includes various Zalando specific libraries like e.g. [ZMON Actuator](#), [Tracer](#) and [Failsafe Actuator](#). See the full list below.



## BUILD & TEST

# CONTINUOUS DELIVERY PLATFORM: BUILD





## Some checks haven't completed yet

[Hide all checks](#)

1 pending and 4 successful checks

- **zappr** Pending — This PR needs 2 more approvals (0/2 given).

**Required**

- ✓ **pipeline** — Pipeline succeeded.

[Details](#)

- ✓ **process/[REDACTED] dev** — Process step succeeded.

[Details](#)

- ✓ **process/[REDACTED] test** — Process step succeeded.

[Details](#)

- ✓ **zappr/pr/specification** — PR has passed specification checks

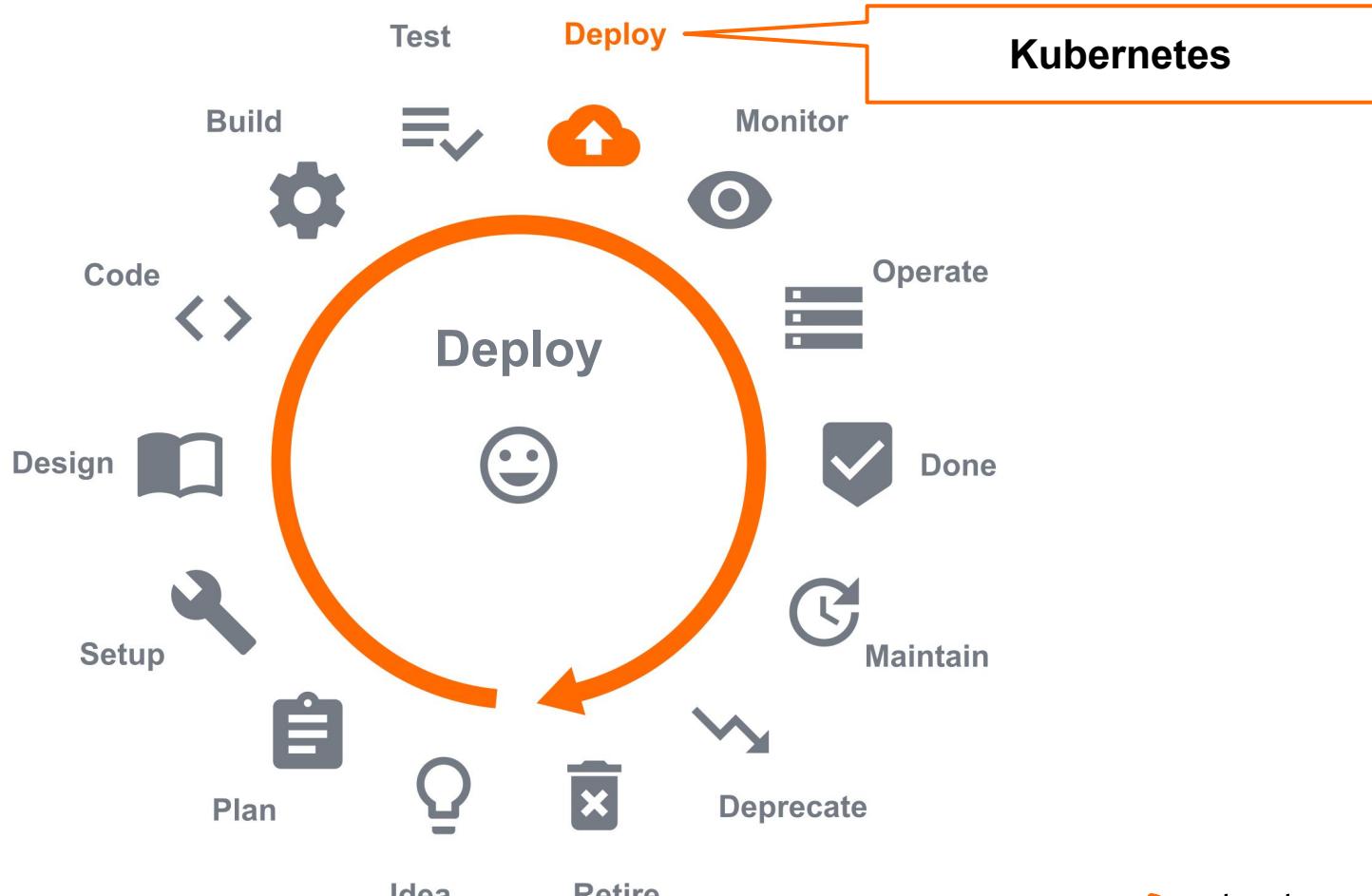
**Required**

## This pull request can be automatically merged by project collaborators

Only those with [write access](#) to this repository can merge pull requests.



# DEPLOY



# DEPLOYMENT CONFIGURATION

```
└── deploy/apply
    ├── deployment.yaml
    ├── credentials.yaml # Zalando IAM
    ├── ingress.yaml
    └── service.yaml
    delivery.yaml          # Zalando CI/CD
```



# INGRESS.YAML

```
kind: Ingress
metadata:
  name: "..."
spec:
  rules:
    # DNS name your application should be exposed on
    - host: "myapp.foo.example.org"
      http:
        paths:
          - backend:
              serviceName: "myapp"
              servicePort: 80
```



# TEMPLATING: MUSTACHE

```
kind: Ingress
metadata:
  name: "..."
spec:
  rules:
    # DNS name your application should be exposed on
    - host: "{{{APPLICATION}}}example.org"
      http:
        paths:
          - backend:
              serviceName: "{{{APPLICATION}}}"
              servicePort: 80
```

# CONTINUOUS DELIVERY PLATFORM

DEPLOYMENT UNITS	RENDERING-ENGINE	Exclude PRs: <input type="checkbox"/>					
Pipeline	Started	Action	Pipeline Runs				
pr-1785-2	3h ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
pr-1785-1	3h ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
Remove `any` usage from our code pr-1784-1	6h ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
master-1188 master-1188	1d ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
Do not bundle node_modules in re package pr-1783-1	1d ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
master-1187 master-1187	1d ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
Document the renderer contribution workflow pr-1775-2	2d ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
master-1186 master-1186	2d ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
pr-1778-1	2d ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>
Document the renderer contribution workflow pr-1775-1	6d ago	<a href="#">i</a>	<a href="#"> BUILD</a>	<a href="#"> PERF</a>	<a href="#"> DEPLOY-BRANCH</a>	<a href="#"> TEST-BRANCH</a>	<a href="#"> DEPLOY-DOCS</a>

# CDP: DEPLOY

The screenshot shows a deployment monitoring interface with the following sections:

- Top Navigation:** DEPLOYMENT UNITS, TRACKING-DEPLOY, MASTER-91.
- Environment Headers:** TRACKING-DEPLOY, TEST, STAGING, PROD.
- Resource Tree:** Deployment **merchant-parcels** (green), ReplicaSet **merchant-parcels-bd76cbc9b** (green), Pod **merchant-parcels-bd76cbc9b-s84kp** (green), Pod **merchant-parcels-bd76cbc9b-bwzff** (green), Pod **merchant-parcels-bd76cbc9b-hgj5p** (green), Ingress **merchant-parcels** (green), Hostname (grey bar), PlatformCredentialsSet (grey bar), postgresql (grey bar), Secret (grey bar), Service **merchant-parcels** (green).
- Status Indicators:** TEST, STAGING, PROD environments are shown with cloud icons.
- Timeline:** Ran for 1 m, 16 s.
- Feedback Form:** Please give us your feedback. Questions: Do you like the new deployment status? (Yes/No). Suggestion: What could be improved upon? Submit button.

*"glorified kubectl apply"*

# CDP: OPTIONAL APPROVAL

The screenshot shows the Zalando Developer Console interface. At the top, there's a navigation bar with 'Developer Console' on the left, a search bar in the center, and 'Feedback' and 'Support' links on the right. Below the navigation bar, there are tabs for 'DEPLOYMENT UNITS', 'FEED-SERVICE', and 'MASTER-16'. The 'FEED-SERVICE' tab is selected and highlighted in grey. To the right of these tabs is a circular orange progress indicator.

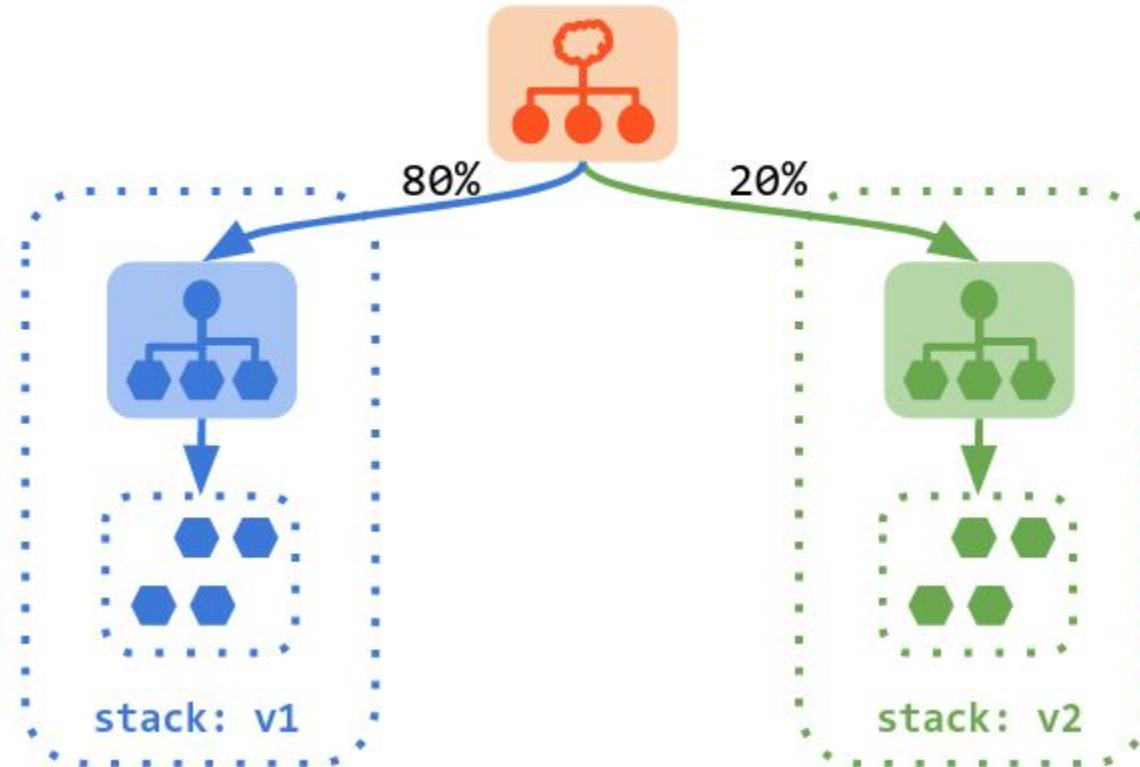
The main content area has several sections:

- GENERAL** and **LOGS** tabs are visible at the top of a grey sidebar.
- ACTIONS** section contains two buttons: 'APPROVE' (with a green thumbs-up icon) and 'REJECT' (with a red thumbs-down icon).
- DETAILS** table:

Id	n/a
Type	process
Status	PENDING_APPROVAL
Deployment	deploy-prod
Cluster	[redacted]
Started at	n/a
Finished at	n/a
- ERRORS & WARNINGS** section:

Error	No Error
Warning	No Warnings

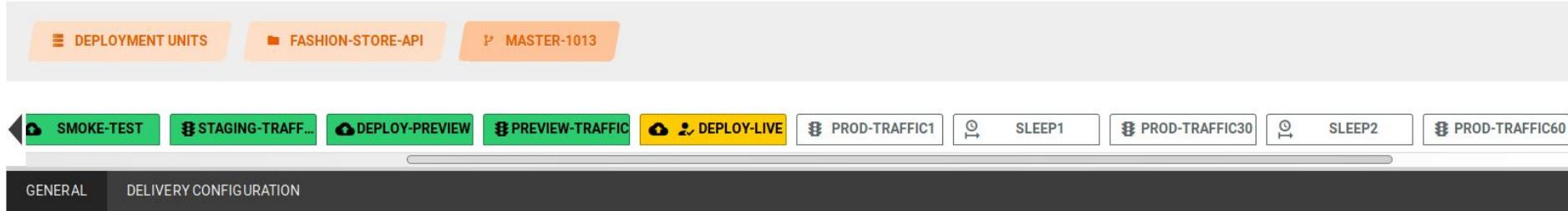
# STACKSET: TRAFFIC SWITCHING



# STACKSET CRD

```
apiVersion: zalando.org/v1
kind: StackSet
...
spec:
  ingress:
    hosts: ["foo.example.org"]
    backendPort: 8080
  stackLifecycle:
    scaledownTTLSeconds: 1800
    limit: 5
  stackTemplate:
    spec:
      podTemplate:
        ...
github.com/zalando-incubator/stackset-controller
```

# TRAFFIC SWITCHING STEPS IN CDP



# EMERGENCY ACCESS SERVICE

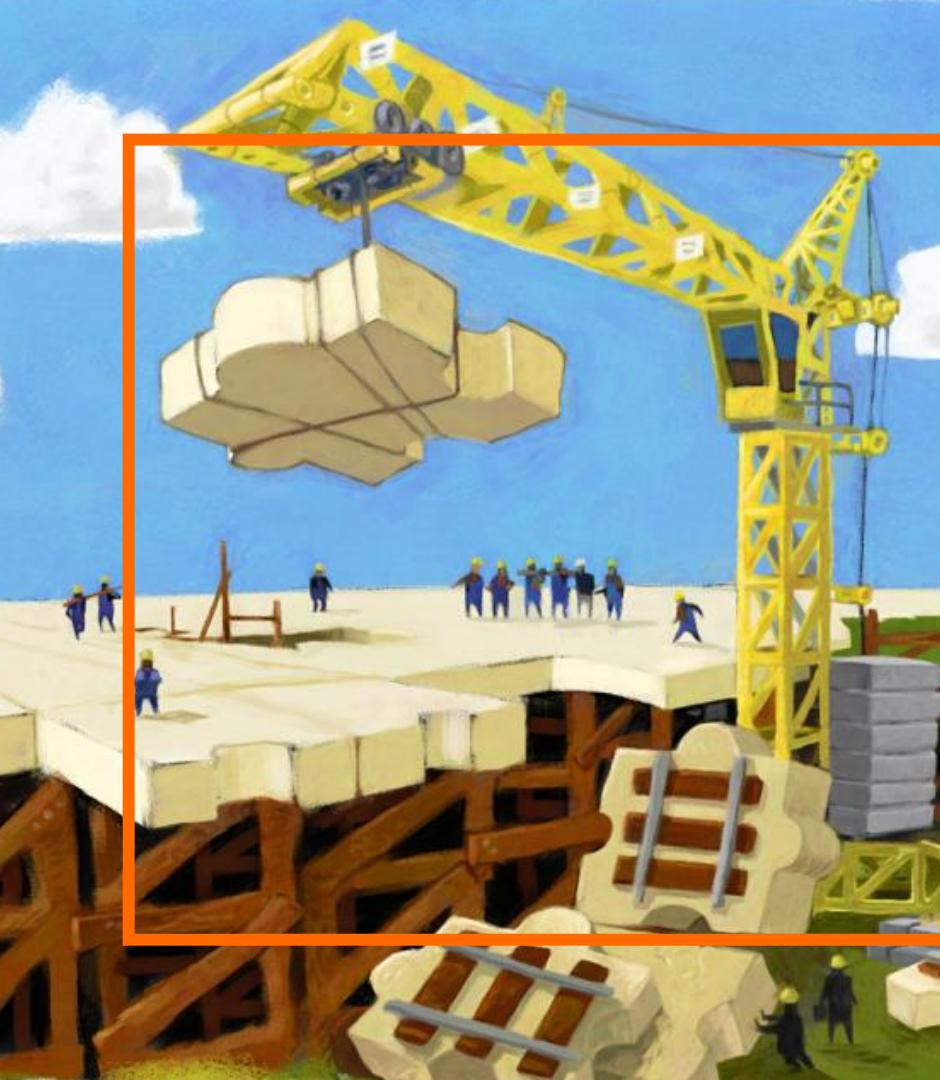
Get emergency access by referencing existing Incident ticket:

```
zkubectl cluster-access request --emergency -i INC REASON
```

Get privileged production access via 4-eyes:

```
zkubectl cluster-access request REASON
```

```
zkubectl cluster-access approve USERNAME
```



## INTEGRATIONS



# CLOUD FORMATION VIA CI/CD

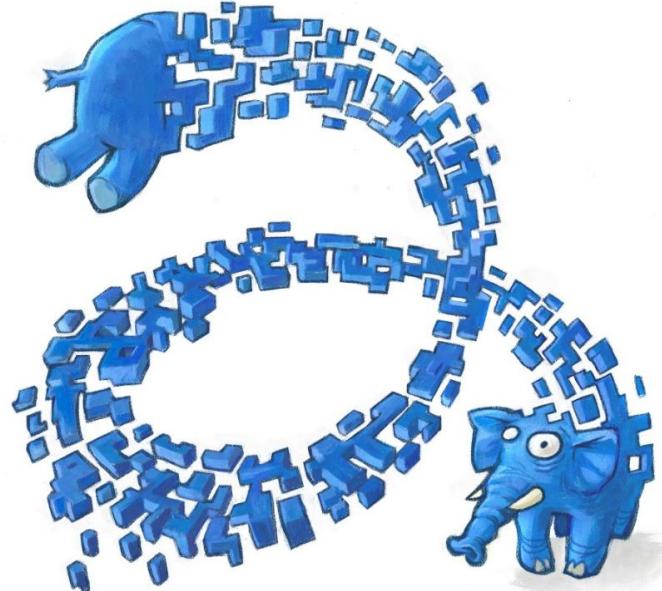
*"Infrastructure as Code"*

```
└── deploy/apply
    ├── deployment.yaml          # Kubernetes
    ├── cf-iam-role.yaml        # AWS IAM Role
    ├── cf-rds.yaml             # AWS RDS Database
    ├── kube-ingress.yaml
    ├── kube-secret.yaml
    └── kube-service.yaml
└── delivery.yaml            # CI/CD config
```

# ZALANDO IAM/OAUTH VIA CRD

```
apiVersion: zalando.org/v1
kind: PlatformCredentialsSet
..
spec:
  application: my-app
  tokens:
    read-only:
      privileges:
        - com.zalando::foobar.read
  clients:
    employee:
      grant: authorization-code
      realm: users
      redirectUri: https://example.org/auth/callback
```

# POSTGRES OPERATOR



Application to manage  
PostgreSQL clusters on  
Kubernetes

**>700**

clusters running  
on Kubernetes



Elasticsearch  
2.500 vCPUs  
1 TB RAM

# Elasticsearch in Kubernetes

[github.com/zalando-incubator/es-operator/](https://github.com/zalando-incubator/es-operator/)

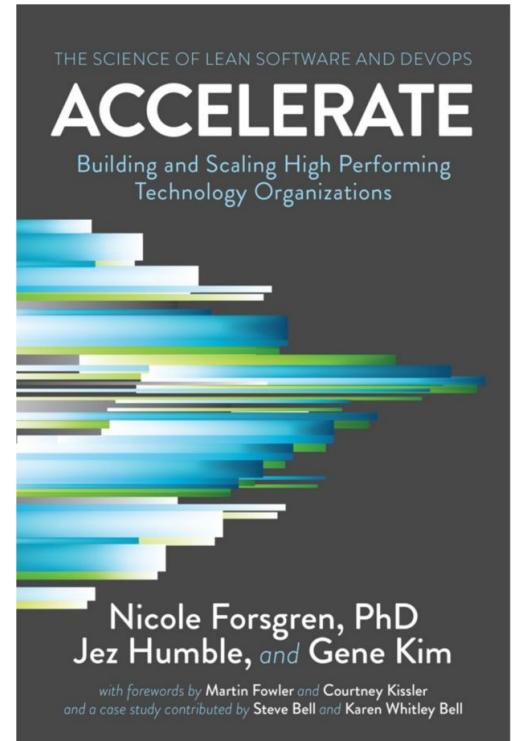
# SUMMARY

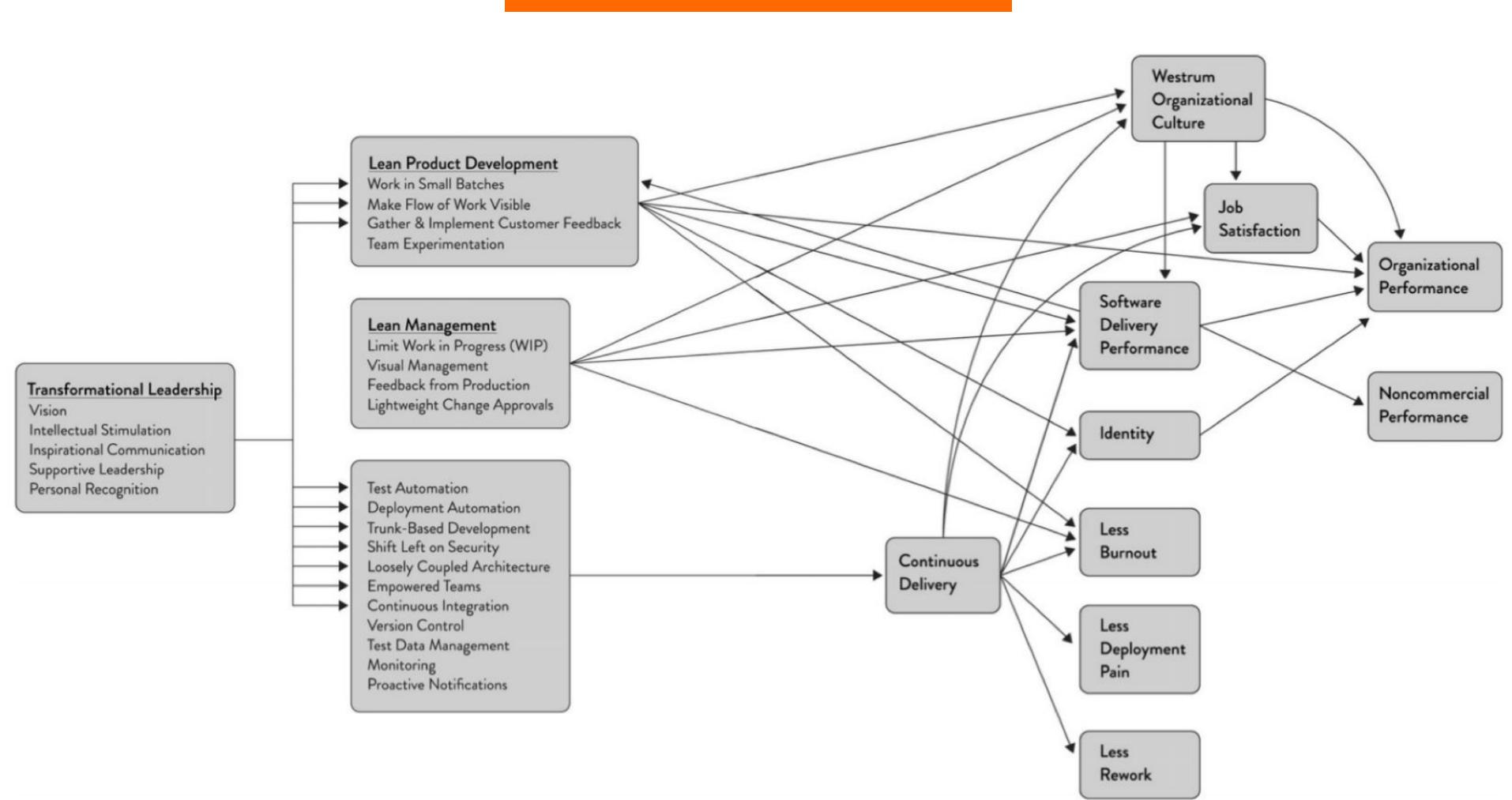
- Application **Bootstrapping**
- **Git** as source of truth and UI
- **4-eyes** principle for master/production
- Extensible **Kubernetes API** as primary interface
  - OAuth/IAM credentials
  - PostgreSQL
- **CloudFormation** for proprietary AWS services



# DELIVERY PERFORMANCE METRICS

- Lead Time
- Release Frequency
- Time to Restore Service
- Change Fail Rate





# DELIVERY PERFORMANCE METRICS

- Lead Time  $\hat{=}$  **Commit to Prod**
- Release Frequency  $\hat{=}$  **Deploys/week/dev**
- Time to Restore Service  $\hat{=}$  **MTRS from incidents**
- Change Fail Rate  $\hat{=}$  **n/a**

## Applying product management to internal platforms

TRIAL

We've s  
to roll o  
access  
find tha  
Applying  
develop  
the pla  
brand  
manag  
the pla  
underu

NEW

*“.. means establishing empathy with internal consumers (read: developers) and collaborating with them on the design. Platform product managers establish roadmaps and ensure the platform delivers value to the business and enhances the developer experience.”*

- *ThoughtWorks Technology Radar*

oking  
vice  
We  
ng.  
read:  
nsure  
e a  
ct  
reating  
gnant,

Do you use any software development tools as part of your daily work? \*

Yes

No

Overall, how satisfied or dissatisfied are you with your Zalando developer experience? \*

1    2    3    4    5    6    7    8    9    10

Extremely  
Dissatisfied



Extremely  
Satisfied

If you needed support for the developer tools you use, how satisfied or dissatisfied are you with the support you received? \*

0    1    2    3    4    5    6    7    8    9    10

Not Applicable

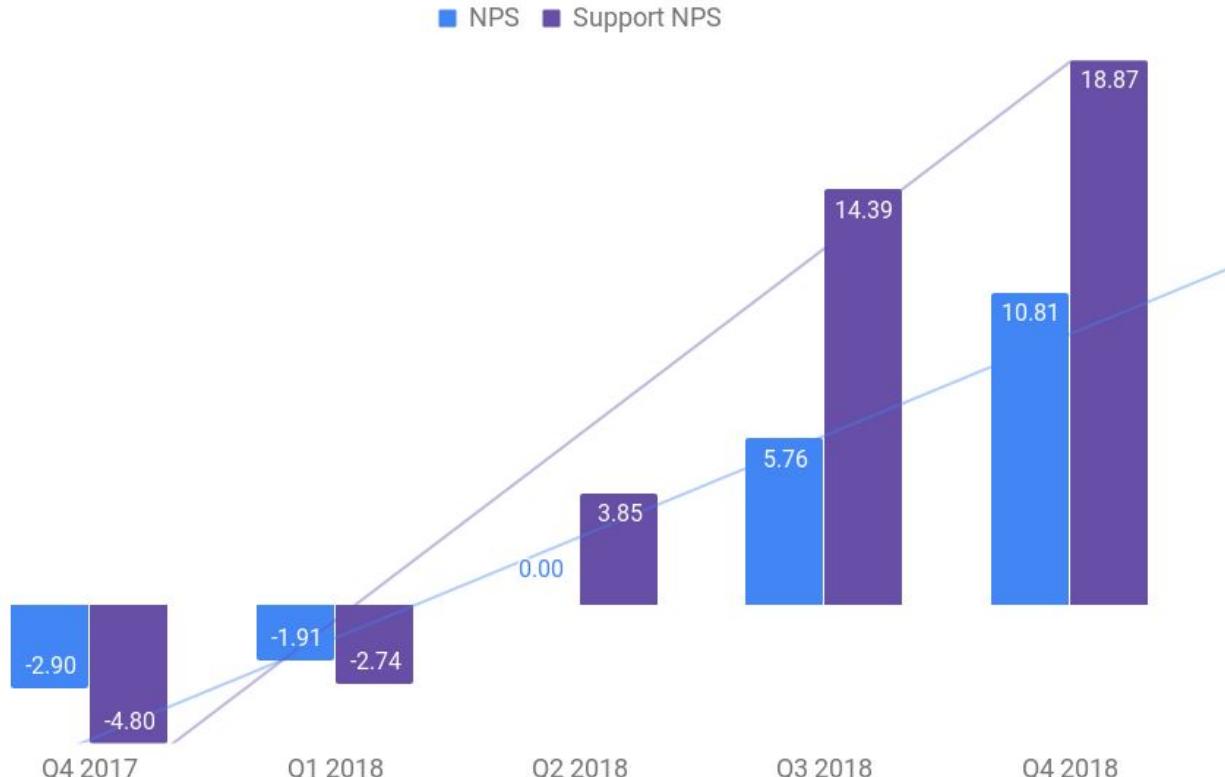


Extremely  
Satisfied

What could we do from your perspective to make the developer experience at Zalando even better?

Your answer

# DEVELOPER SATISFACTION



# DOCUMENTATION

*"Documentation is hard to find"*

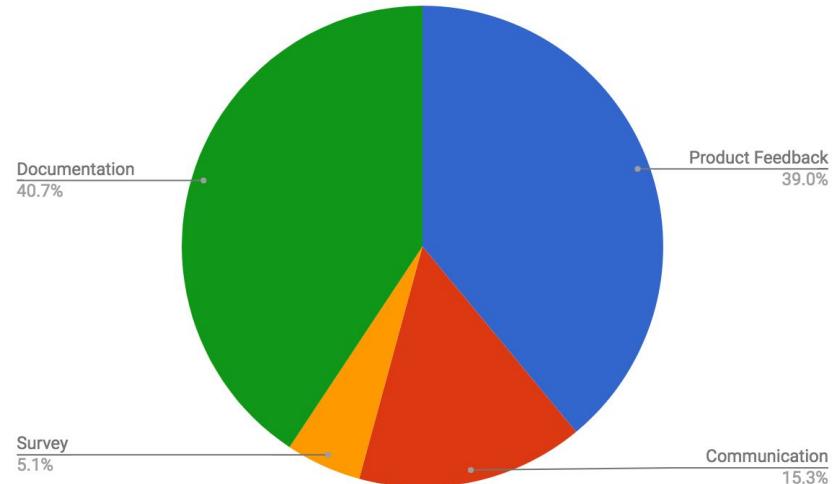
*"Documentation is not comprehensive enough"*

*"Remove unnecessary complexity and obstacles."*

*"Get the documentation up to date and prepare  
use cases"*

*"More and more clear documentation"*

*"More detailed docs, example repos with more  
complicated deployments."*



# DOCUMENTATION

- Restructure following  
<https://www.divio.com/en/blog/documentation/>
  - Concepts
  - How Tos
  - Tutorials
  - Reference
- Global Search
- Weekly Health Check: Support → Documentation



Documentation (how much did we improve? emphasis on support)

▼ ▼ ▼ ▼ ▼ yellow Red ▼ yellow ▼ yellow ▼

**APPLICATIONS**

Pipelines

**TOOLS**

Repositories

Clusters

Kube Resource Report

**PUBLISH****DISCOVERABLE****DOCUMENTATION****Learn more****Search Results**

Search finished, found 123 item(s) matching the search query

**Databases - Cloud Native Application Runtime**</reference/using-databases/>

Using Databases from the Cluster It is common for an application to depend on a PostgreSQL database

The first option is to deploy a PostgreSQL cluster into your account using the PostgreSQL operator.  
to deploy a PostgreSQL cluster to your K8S cluster.

Just deploy a PostgreSQL manifest to your account (via zkubectl or CDP). kind: " postgresql " apiVersion  
\\zalan.do Delete a database cluster: zkubectl get postgresql zkubectl delete postgresql

**Rotate PostgreSQL Credentials – Discount Service documentation**[/operations/guides/rotate\\_postgresql\\_keys.html](/operations/guides/rotate_postgresql_keys.html)

Rotate PostgreSQL Credentials For security reasons, all PostgreSQL credentials must be rotated every

**Postgresql · GitBook**</postgresql-24x7.html>

PostgresShort descriptionPostgres is used in Team

**Migration from Stups - Cloud Native Application Runtime**</reference/migration/>

The application has the following components: RDS PostgreSQL database Docker container ELB load balancer

**Kubernetes Best Practices - Cloud Native Application Runtime**</concepts/kubernetes-best-practices/>

this is just a redeployment with a different target namespace, but for stateful applications, like a postgresql

# NEWSLETTER

"You can now.."

- You can now benefit from the most recent Kubernetes 1.12 features, e.g. ..
- You can now analyse your Kotlin project with SonarQube and upload your Scala code coverage report to SonarQube

# SIGNAL: ISSUE UPVOTES

## Uploading things to S3 from CDP builds #63

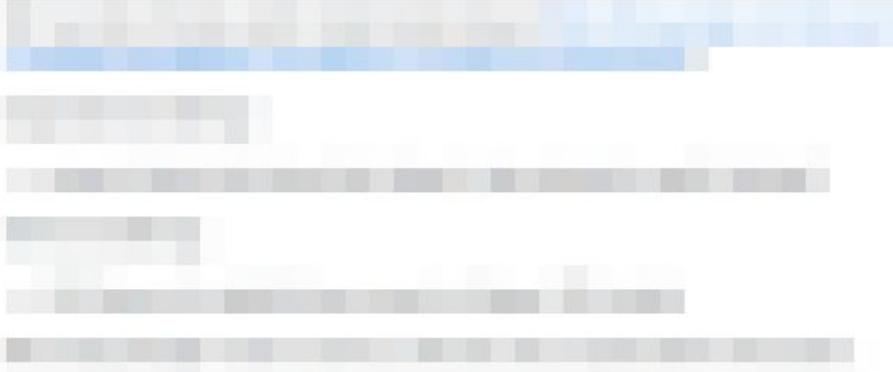
 Closed

[REDACTED] opened this issue on Feb 15, 2018 · 34 comments

commented on Feb 15, 2018 · edited

Member + ...

Users regularly ask to upload build artifacts to S3 from CDP builds (to their teams' S3 buckets).



 38     1

# TESTIMONIALS

*“So, thank you, Team Automata, for listening to our community, taking our upvotes in consideration when developing new solutions and building every day  
**'the first CI that doesn't suck'.**”*

*- a user, October 2018*



# MONITORING

# ZMON DASHBOARD

 ZMON Dashboards Cloud Entities Check defs Alert defs Trial Run

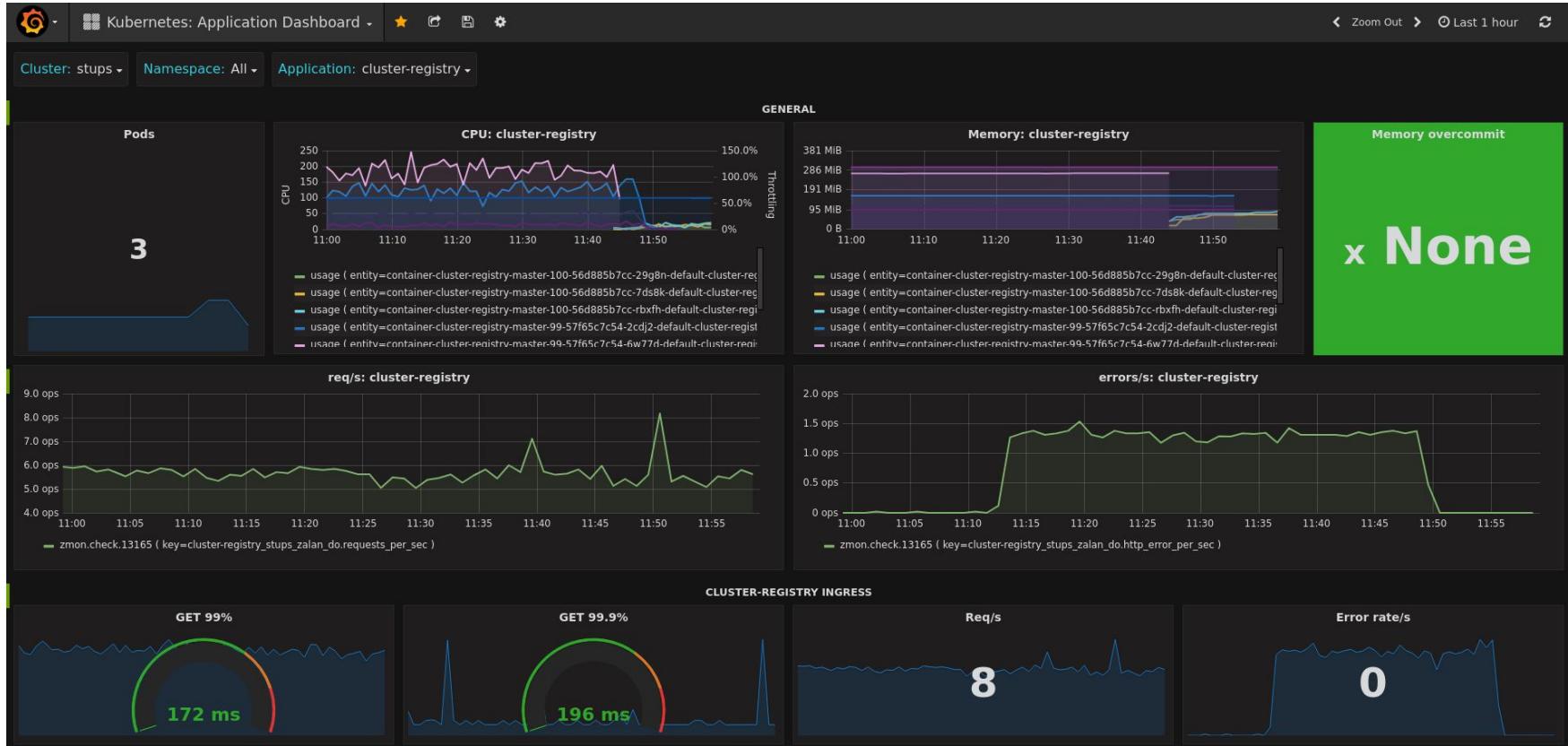
0 in queue, 1/1 active, 0.00/s 11:39 🔔 ? 📈 🔍 mlarsen

🔍 Search for alerts ⚡ 3 Hide Widgets ⌂ ⚙️

<p>⚠ Kubernetes: CLM clusters with problems: {cluster} (27)</p>	3m	<p>etcd: snapshots too old "governance: no backups"</p>	29m
<p>⚠ AWS limits insufficient {info} (23)</p>	2m	<p>Cluster Registry success rate SLO breach</p>	17m
<p>Kubernetes DNS healthy</p>	4h	<p>Cluster ASG scaling issues (prod): "aws:343040485429 (0..0 instances, 1..1 desired)"</p>	8h

[github.com/zalando/zmon](https://github.com/zalando/zmon)

# GRAFANA APPLICATION DASHBOARD



# KUBERNETES RESOURCE REPORT

Overview Clusters Ingresses Teams Applications Pods

**Cluster [REDACTED]**  
[https://\[REDACTED\]](https://[REDACTED])

MASTER NODES	WORKER NODES	PODS	CPU REQUESTS / ALLOCATABLE	MEMORY REQUESTS / ALLOCATABLE	MONTHLY COST
2	15	325	55.7 / 60.6	183.1 GiB / 241.5 GiB	1,687.16 USD

You can potentially save [REDACTED] every month by optimizing resource requests and reducing slack.

Price per requested vCPU is [REDACTED] per hour and per requested GiB memory is [REDACTED] per hour.

### Nodes

Name	Role	Instance Type	S?	Version	CC	MC	CPU	Memory (GiB)	Cost
[REDACTED]	worker	m4.xlarge	✗	v1.10.5	4	15.7 GiB		0.7 3.7 3.8 3.7 10.8 15.1	70.13
[REDACTED]	worker	m4.xlarge	✗	v1.10.5	4	15.7 GiB		1.0 3.4 3.8 7.2 14.1 15.1	70.13
[REDACTED]	worker	m4.xlarge	✗	v1.10.5	4	15.7 GiB		0.2 3.8 3.8 3.4 8.0 15.1	70.13
[REDACTED]	master	m4.large		v1.10.5	2	7.8 GiB		0.3 1.0 1.8 2.8 1.3 7.3	87.66
[REDACTED]	worker	m4.xlarge	✗	v1.10.5	4	15.7 GiB		0.2 2.7 3.8 3.3 9.4 15.1	70.13

# RESOURCE REPORT: TEAMS

ID	C	A	P	CR	MR	CPU	Memory (MiB)	Cost	Slack Cost			
	3	14	114	457.9	1.7 TiB	69.01	457.9	1,074,024	1,780,420	27,558.50	13,327.47	<input type="button" value=" "/>
	1	9	251	428.95	426.2 GiB	137.99	428.95	164,613	436,384	19,406.82	13,111.24	<input type="button" value=" "/>



Sorting teams by  
Slack Costs

# RESOURCE REPORT: APPLICATIONS

You can potentially save **2,474.14 USD** every month by optimizing resource requests and reducing slack.

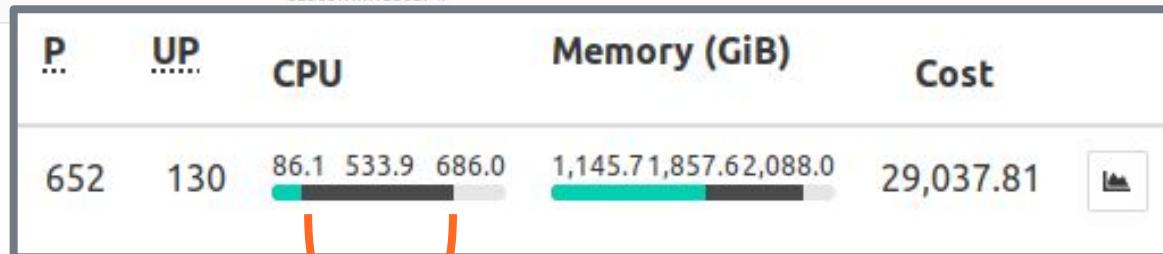
## Applications

ID	A?	C	P	CR	MR	CPU	Memory (MiB)	Cost	Slack Cost
felicity	✓	2	16	40.0	109.4 GiB	<div style="width: 26.97%;">26.97</div> 40.0	<div style="width: 75,333px;">75,333</div> 112,000	2,126.64	598.24
live-kafka-	✓	1	12	24.0	175.8 GiB	<div style="width: 5.93%;">5.93</div> 24.0	<div style="width: 125,274px;">125,274</div> 180,000	1,858.43	565.02
live-elasticsearch-	✓	1	6	9.0	82.0 GiB	<div style="width: 0.01%;">0.01</div> 9.0	<div style="width: 30,107px;">30,107</div> 84,000	970.18	659.34
live-	✓	1	16	14.0	87.5 GiB	<div style="width: 7.47%;">7.47</div> 14.0	<div style="width: 85,167px;">85,167</div> 89,600	925.08	45.77

"Slack"

# RESOURCE REPORT: CLUSTERS

Cluster	MN	WN	Inst. Types	S?	Version	I	P	UP	CPU	Memory (GiB)	Cost
	2	58	c5d.2xlarge, m5.large, m5.4xlarge, c5.2xlarge, m5d.2xlarge, c5.4xlarge	v1.12.5-custom.master-1		26	652	130	<div style="width: 86.1%;">86.1</div> 533.9 686.0	<div style="width: 1145.7%;">1,145.7</div> 1,857.62,088.0	29,037.81 
	1	18	m5d.xlarge, r4.xlarge	x v1.12.5-custom.master-1		13	223	36	<div style="width: 7.7%;">7.7</div> 32.2 70.2	<div style="width: 195.9%;">195.9</div> 227.1 374.5	3,986.41 



"Slack"



## UNDER THE HOOD

# ZALANDO: DECISION

## 1. Forbid Memory Overcommit

- Implement mutating admission webhook
- Set requests = limits

## 2. Disable CPU CFS Quota in all clusters

- `--cpu-cfs-quota=false`

# KUBERNETES CLUSTER SETUP



Master



Master



Config



Core OS



EC2  
Instances



Worker



CloudFormation  
Stacks

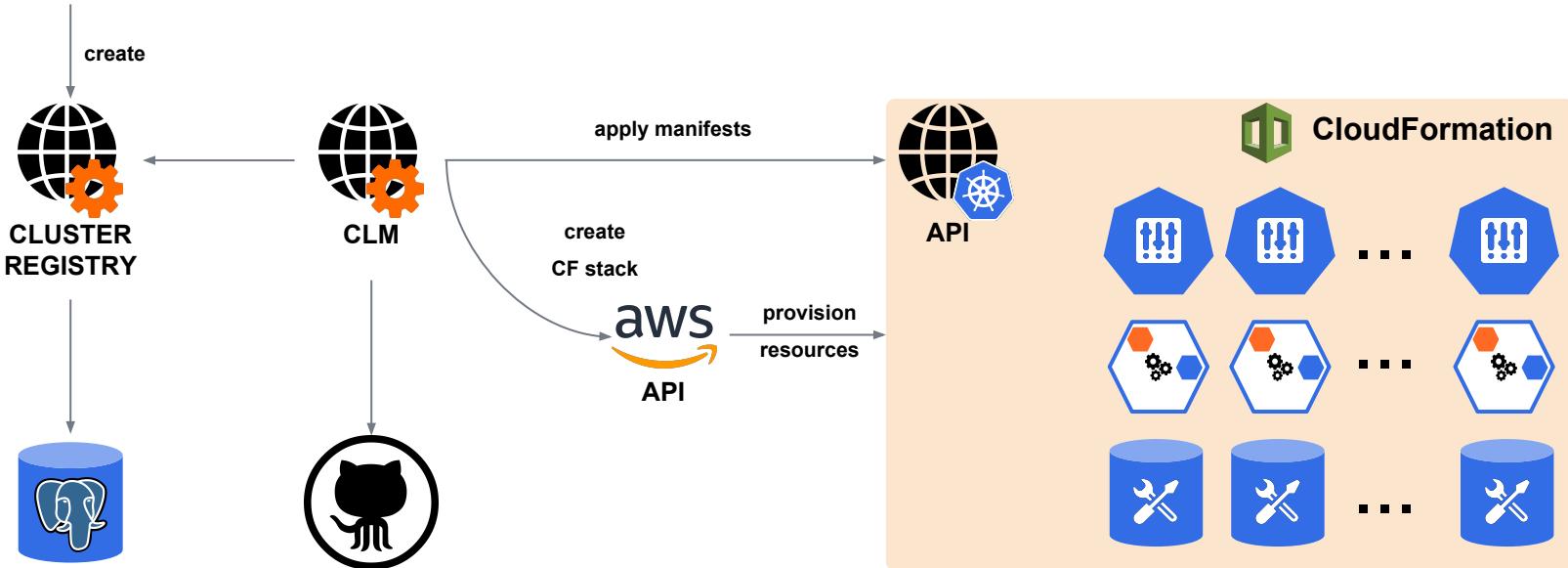
[github.com/zalando-incubator/kubernetes-on-aws](https://github.com/zalando-incubator/kubernetes-on-aws)

# CLUSTER PROVISIONING

## CLUSTER LIFECYCLE MANAGER (CLM)



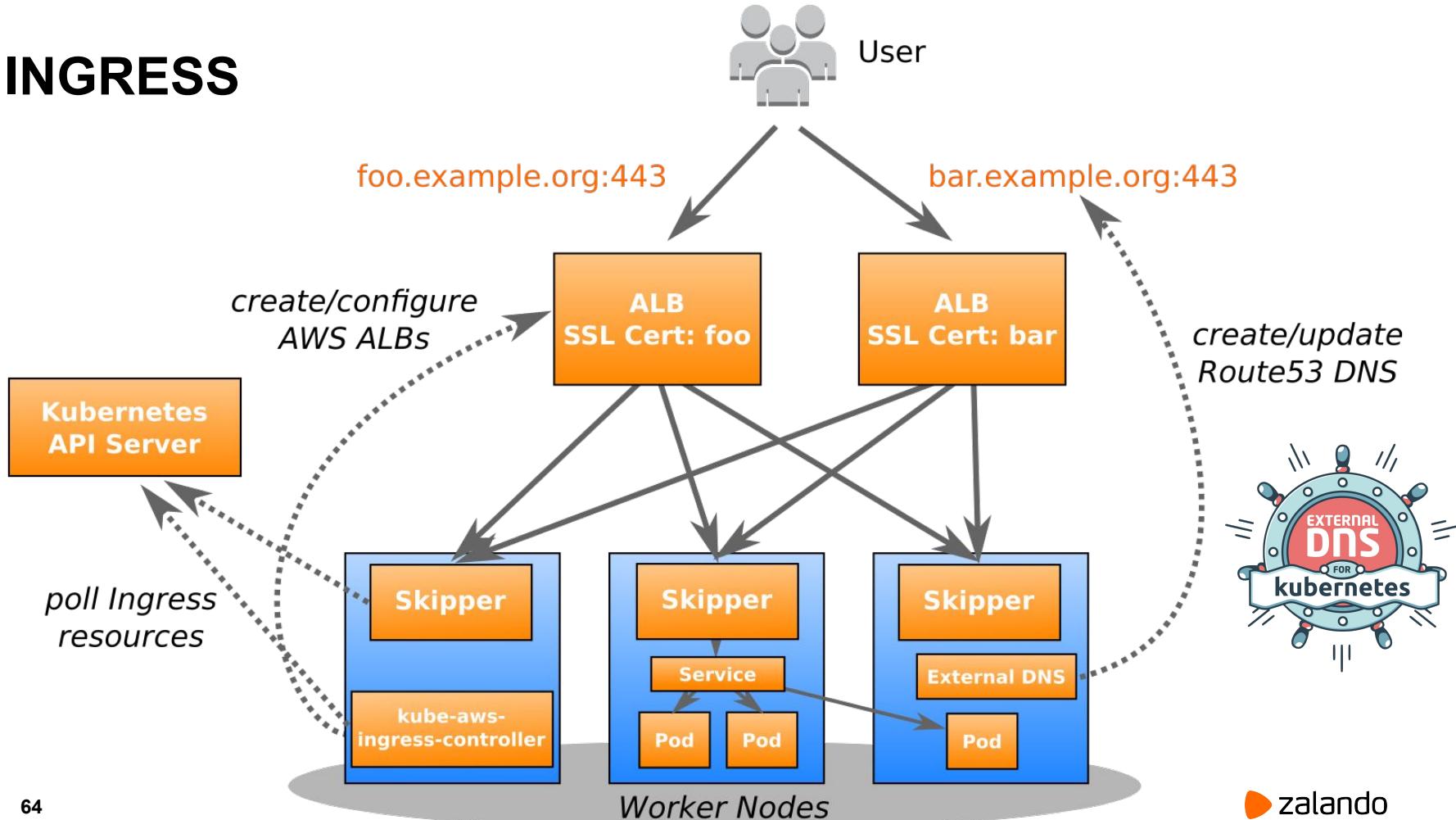
ADMIN



[github.com/zalando-incubator/cluster-lifecycle-manager](https://github.com/zalando-incubator/cluster-lifecycle-manager)

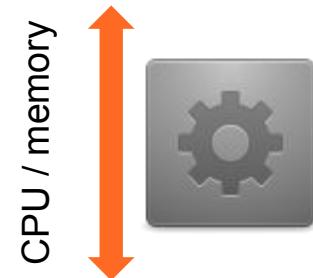
[github.com/zalando-incubator/kubernetes-on-aws](https://github.com/zalando-incubator/kubernetes-on-aws)

# INGRESS

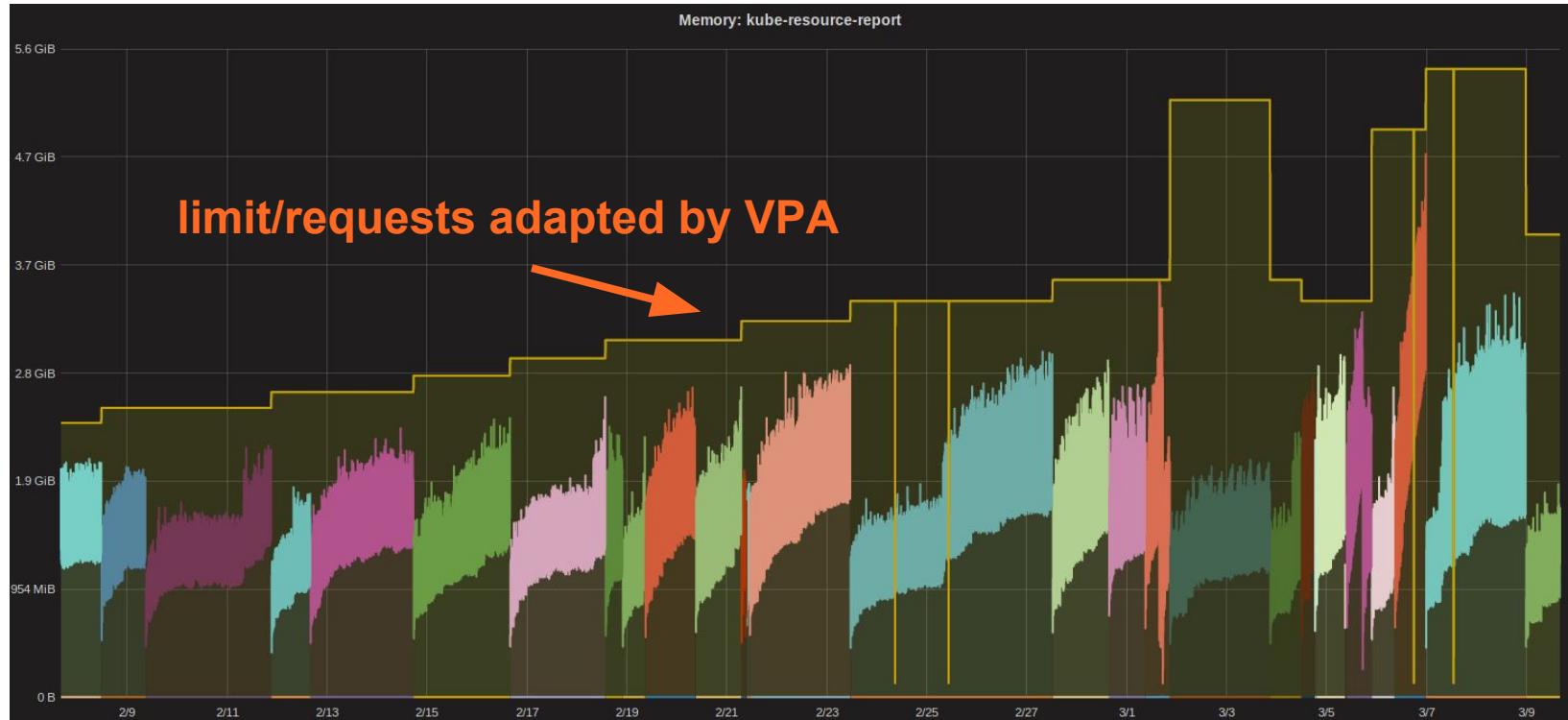


# VPA FOR PROMETHEUS

```
apiVersion: poc.autoscaling.k8s.io/v1alpha1
kind: VerticalPodAutoscaler
metadata:
  name: prometheus-vpa
  namespace: kube-system
spec:
  selector:
    matchLabels:
      application: prometheus
  updatePolicy:
    updateMode: Auto
```



# VERTICAL POD AUTOSCALER

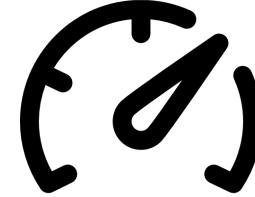


# HORIZONTAL POD AUTOSCALING (CUSTOM METRICS)



amazon  
SQS

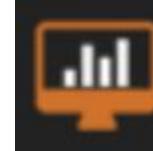
Queue Length



Ingress Req/s

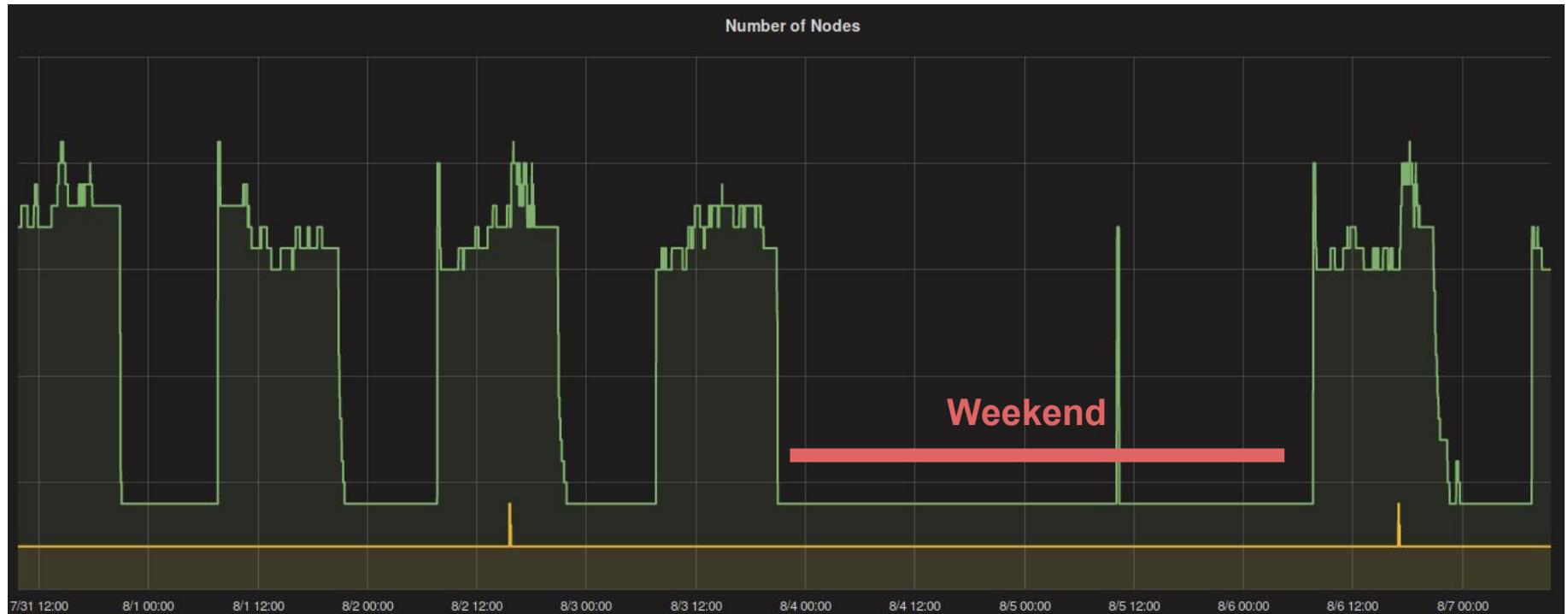


Prometheus Query



ZMON Check

# DOWNSCALING DURING OFF-HOURS

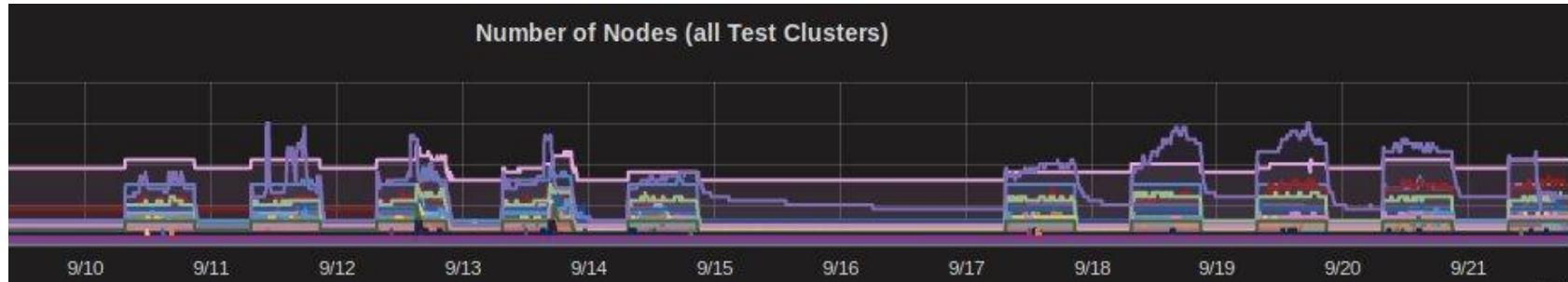


# DOWNSCALING DURING OFF-HOURS

`DEFAULT_UPTIME="Mon-Fri 07:30-20:30 CET"`

annotations:

`downscaler/exclude: "true"`



# KUBERNETES JANITOR

 [hjacobs / kube-janitor](#)

 [Code](#)     [Issues 4](#)     [Pull requests 2](#)     [Insights](#)

 [Watch](#) 1     [Star](#) 55     [Fork](#) 2

Clean up (delete) Kubernetes resources after a configured TTL (time to live)

[kubernetes](#)    [kubernetes-operator](#)    [cleanup](#)    [resource-management](#)    [ttl](#)    [garbage-collector](#)

- **TTL** and **expiry date** annotations, e.g.
  - set time-to-live for your test deployment
- **Custom rules**, e.g.
  - delete everything without "app" label after 7 days

# JANITOR TTL ANNOTATION

```
# let's try out nginx, but only for 1 hour
kubectl run nginx --image=nginx
kubectl annotate deploy nginx janitor/ttl=1h
```

# CUSTOM JANITOR RULES

```
# require "app" label for new pods starting April 2019
- id: require-app-label-april-2019
  resources:
    - deployments
    - statefulsets
  jmespath: "!(spec.template.metadata.labels.app) &&
              metadata.creationTimestamp > '2019-04-01'"
  ttl: 7d
```

# EC2 SPOT NODES

Role	Instance Type	S?	Version	CC	MC	CPU	Memory (GiB)	Cost
worker	m4.2xlarge		v1.12.5-custom.master-1	8	31.4 GiB	<div style="width: 1.6%;">1.6</div> <div style="width: 6.9%;">6.9</div> <div style="width: 7.8%;">7.8</div>	<div style="width: 8.8%;">8.8</div> <div style="width: 14.3%;">14.3</div> <div style="width: 30.9%;">30.9</div>	350.64
worker	m4.4xlarge	✖	v1.12.5-custom.master-1	16	62.9 GiB	<div style="width: 4.1%;">4.1</div> <div style="width: 9.0%;">9.0</div> <div style="width: 15.8%;">15.8</div>	<div style="width: 51.2%;">51.2</div> <div style="width: 62.3%;">62.3</div> <div style="width: 62.4%;">62.4</div>	193.73

72% savings

# SPOT ASG / LAUNCH TEMPLATE

```
10 AutoScalingGroup:  
11   CreationPolicy:  
12     ResourceSignal:  
13       Count: '0'  
14       Timeout: PT15M  
15   Properties:  
16     HealthCheckGracePeriod: 300  
17     HealthCheckType: EC2  
18 {{ if gt (len .NodePool.InstanceTypes) 1 }}  
19     MixedInstancesPolicy:  
20       InstancesDistribution:  
21         OnDemandPercentageAboveBaseCapacity: {{if eq .NodePool.Discour  
22         SpotInstancePools: {{ len .NodePool.InstanceTypes }}  
23     LaunchTemplate:  
24       LaunchTemplateSpecification:  
25         LaunchTemplateId: !Ref LaunchTemplate  
26         Version: !GetAtt LaunchTemplate.LatestVersionNumber  
27     Overrides:  
28 {{ range $type := .NodePool.InstanceTypes }}  
29       - InstanceType: "{{ $type }}"
```

	Launch Template	<a href="#">i</a>	kube-2-worker-spot
	Launch Template Version	<a href="#">i</a>	8
	Launch Template Description	<a href="#">i</a>	-
	Instance Types	<a href="#">i</a>	r4.2xlarge, r5.2xlarge, r5.4xlarge, r4.4xlarge, r4.8xlarge, r3.8xlarge, r3.4xlarge, m4.10xlarge, r3.2xlarge, m5.4xlarge, m4.4xlarge
	Spot Diversity	<a href="#">i</a>	11
	Optional On-Demand Base	<a href="#">i</a>	0
	On-Demand Percentage	<a href="#">i</a>	0%
	Desired Capacity	<a href="#">i</a>	12

*Not upstream in cluster-autoscaler (yet)*

# OPEN SOURCE

## Kubernetes on AWS

[github.com/zalando-incubator/kubernetes-on-aws](https://github.com/zalando-incubator/kubernetes-on-aws)

## AWS ALB Ingress controller

[github.com/zalando-incubator/kube-ingress-aws-controller](https://github.com/zalando-incubator/kube-ingress-aws-controller)

## External DNS

[github.com/kubernetes-incubator/external-dns](https://github.com/kubernetes-incubator/external-dns)

## Postgres Operator

[github.com/zalando/postgres-operator](https://github.com/zalando/postgres-operator)

## Kubernetes Resource Report

[github.com/hjacobs/kube-resource-report](https://github.com/hjacobs/kube-resource-report)

## Kubernetes Downscaler

[github.com/hjacobs/kube-downscaler](https://github.com/hjacobs/kube-downscaler)

## Kubernetes Janitor

[github.com/hjacobs/kube-janitor](https://github.com/hjacobs/kube-janitor)



# MORE INFO

- [DevOps Gathering 2019: Ensuring Kubernetes Cost Efficiency across \(many\) Clusters \(slides\)](#)
- [DevOpsCon Munich 2018: Running Kubernetes in Production: A Million Ways to Crash Your Cluster](#)
- [HighLoad++ Moscow 2018: Optimizing Kubernetes Resource Requests/Limits for Cost-Efficiency and Latency \(slides\)](#)
- [DevOps Lisbon Meetup 2018: Kubernetes at Zalando](#)

[kubernetes-on-aws.readthedocs.io/en/latest/admin-guide/public-presentations.html](#)



# QUESTIONS?

---

HENNING JACOBS  
HEAD OF  
DEVELOPER PRODUCTIVITY

[henning@zalando.de](mailto:henning@zalando.de)

[@try\\_except](https://github.com/try-except)

Illustrations by [@01k](#)

