What should you know to start building Golang Services for Kubernetes?

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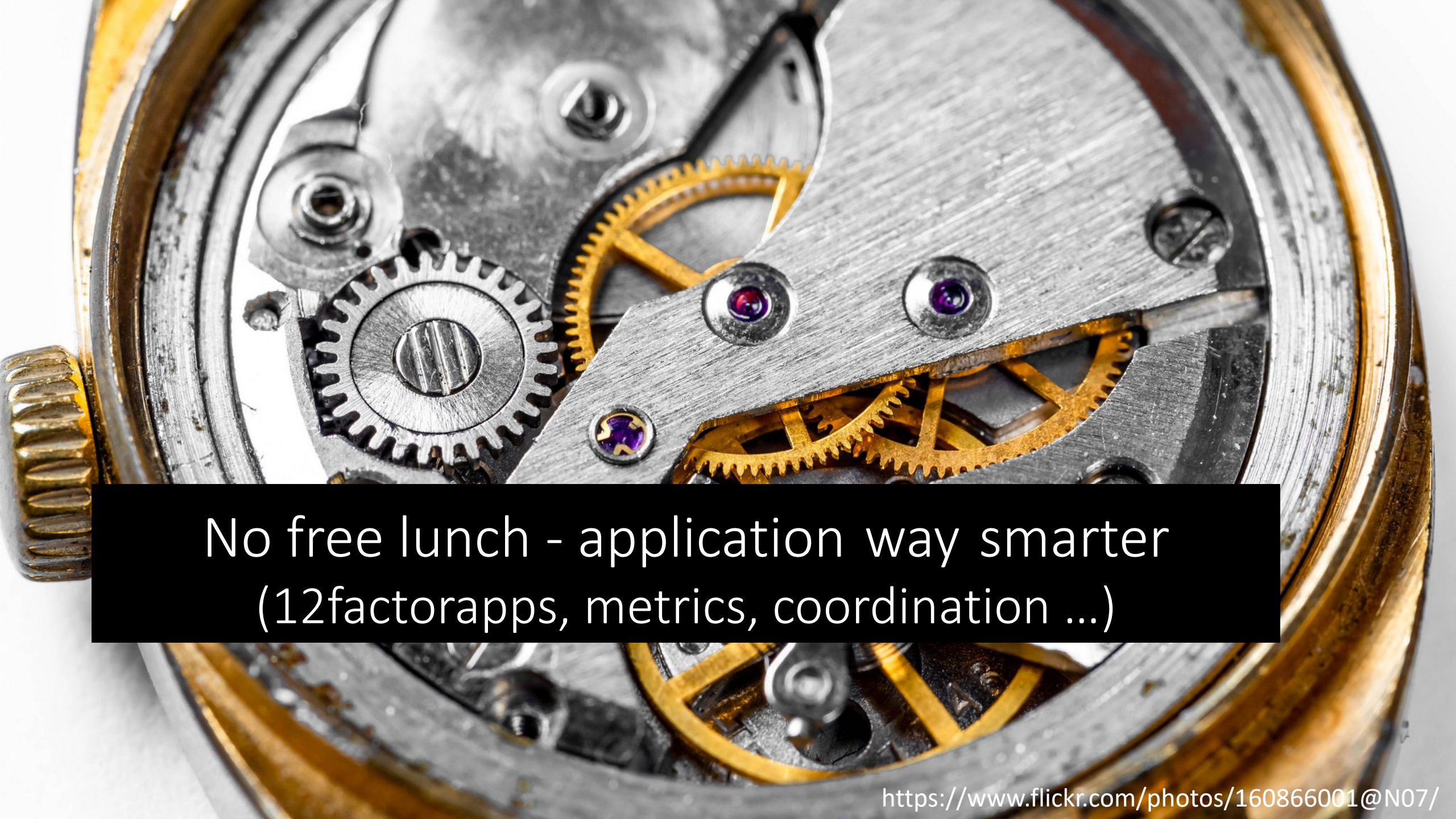
VP of Engineering

SPACELIFT



No free lunch - application way smarter

(12factorapps, metrics, coordination …)

https://www.flickr.com/photos/160866001@N07/

App development

- 12 factor apps
- Observability
- Liveness and Readiness probe
- Working with Kubernetes

THE TWELVE-FACTOR APP

12 factor apps

1. Inject the configuration with the env variables
2. Log to stdout (structured)
3. Scale up the app by adding new instance

https://12factor.net

12 factor apps

4. MTTR versus MTTF, fail fast
5. Assume every external call might fail – retries and timeouts

https://12factor.net

Observability

	Metrics	Logging	Tracing
CapEx	Medium	Low	High
OpEx	Low	High	Medium
Reaction	High	Medium	Low
Investigation	Low	Medium	High

https://peter.bourgon.org/go-for-industrial-programming/

Observability - logging

- structured

  uber-go/zap and logrus

```
logger, _ := zap.NewProduction()
defer logger.Sync() // flushes buffer, if any
sugar := logger.Sugar()
sugar.Infow("failed to fetch URL",
  // Structured context as loosely typed key-value pairs.
  "url", url,
  "attempt", 3,
  "backoff", time.Second,
)
sugar.Infof("Failed to fetch URL: %s", url)
```

Observability - logging

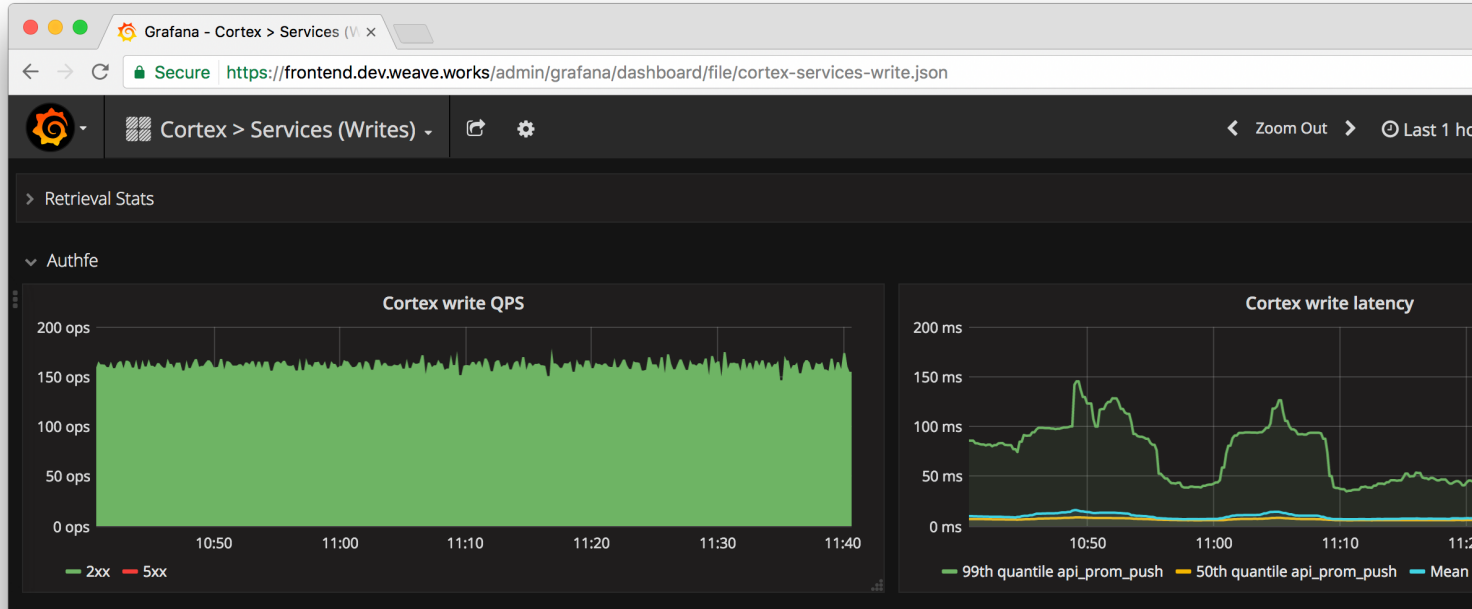
- Pass the logger with Context

```
// A common pattern is to re-use fields between logging statements by re-using
// the logrus.Entry returned from WithFields()
contextLogger := log.WithFields(log.Fields{
  "common": "this is a common field",
  "other": "I also should be logged always",
})
```

- Configurable with env variable - LOG_LEVEL

Observability - monitoring

Name	Label	Value
traefik_requests_total	code="200", method="GET"	3001



Prometheus

Observability - monitoring

- Use Prometheus Golang library
- Monitor yourself
- Monitor your dependencies
- Check the best practices - https://prometheus.io/docs/practices/naming/

https://prometheus.io/docs/guides/go-application/

Observability - monitoring

- Annotate your service

```
apiVersion: v1
kind: Service
metadata:
  name: my-app
  annotations:
      prometheus.io/scrape: 'true'
      prometheus.io/port:   '9090'
      prometheus.io/path: 'metrics/'
spec:
  selector:
    app: my-app
  ports:
    - port: 8080
      target_port: 8080
```

Prometheus

https://prometheus.io/docs/practices/naming/

Observability - monitoring

- RED
  - Rate Error Duration

- USE
  - Utilization Saturation and Errors

Cooperation with K8S

- **Readiness probe**
  - are you ready to server traffic?
  - are my dependencies responding?
- **Liveness probe**
  - am I alive?
  - did I hanged

```
readinessProbe:
  httpGet:
    path: /ready
    port: 8090
```

```
livenessProbe:
  httpGet:
    path: /healthz
    port: 8090
  initialDelaySeconds: 5
  periodSeconds: 5
```

Cooperation with K8S

- **Readiness probe**
  - are you ready to server traffic?
  - are my dependencies responding?

- **Liveness probe**
  - am I alive?
  - did I h

```
readinessProbe:
  httpGet:
    path: /ready
    port: 8090
```

```
livenessProbe:
  httpGet:
    path: /healthz
    8090
    elaySeconds: 5
    econds: 5
```

Start with Liveness.

Cooperation with K8S

When the probe fails:

- **Readiness probe**
  - Kubernetes stops (eventually) sending requests
- **Liveness probe**
  - Kubernetes SIGTERM followed by SIGKILL

When K8S stops your pod

1. Kubernetes sends SIGTERM
2. App should handle it
   and set the readiness probe to not ready
3. Kubernetes stops sending requests
4. App should shutdown gracefully

```
func (s *Service) prepareShutdown(h Server) {
    signal.Notify(s.Stop, os.Interrupt, syscall.SIGTERM)
    <-s.Stop
    s.StatusNotReady()
    shutdown(h)
}
```

QoS – why k8s migrated my pod

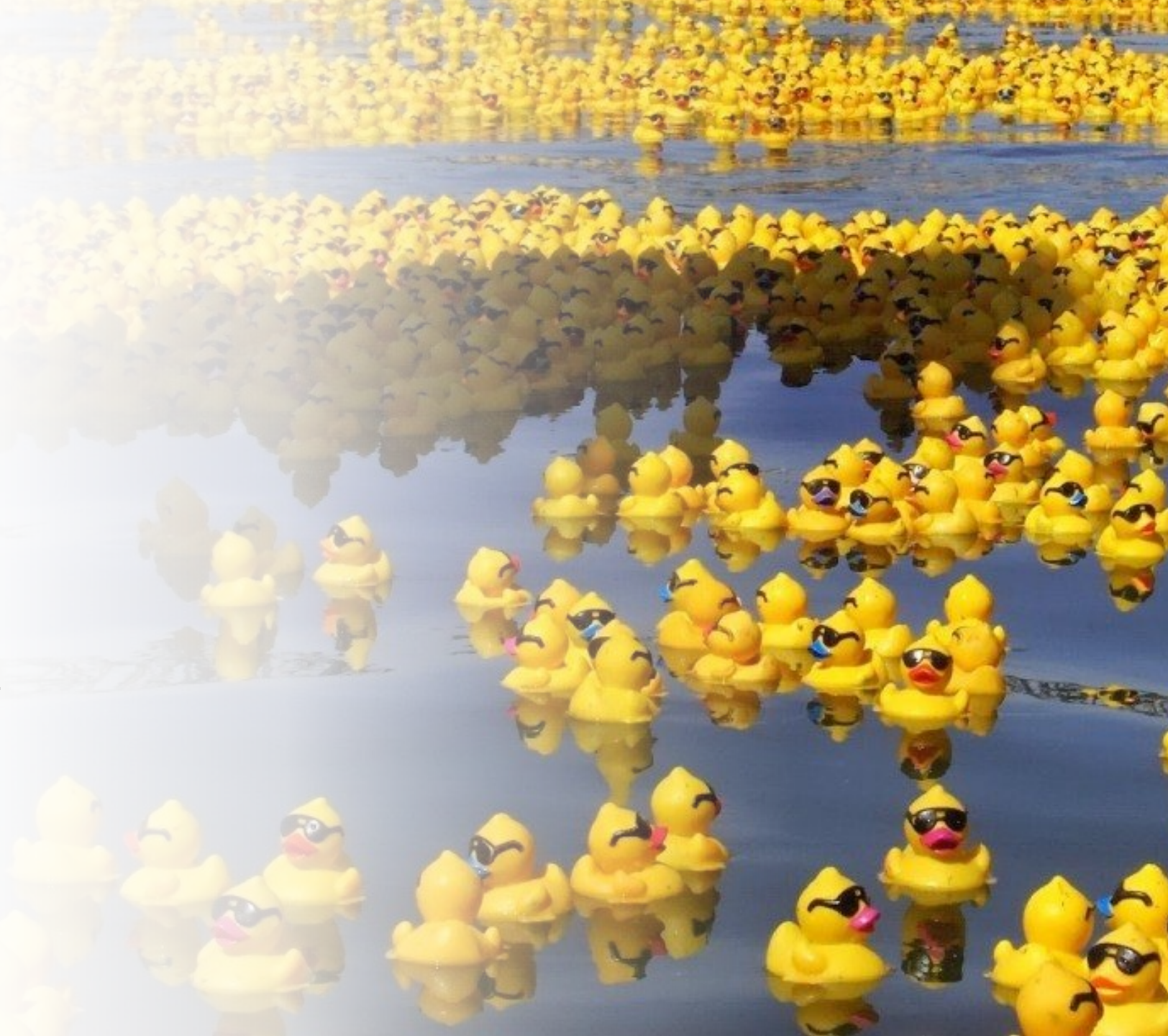
QoS:

- Guaranteed
- Burstable
- Best Effort

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: qos-demo
  namespace: qos-example
spec:
  containers:
  - name: qos-demo-ctr
    image: nginx
    resources:
      limits:
        memory: "200Mi"
        cpu: "700m"
      requests:
        memory: "200Mi"
        cpu: "700m"
```

Smoke test & Readiness /Liveness probes

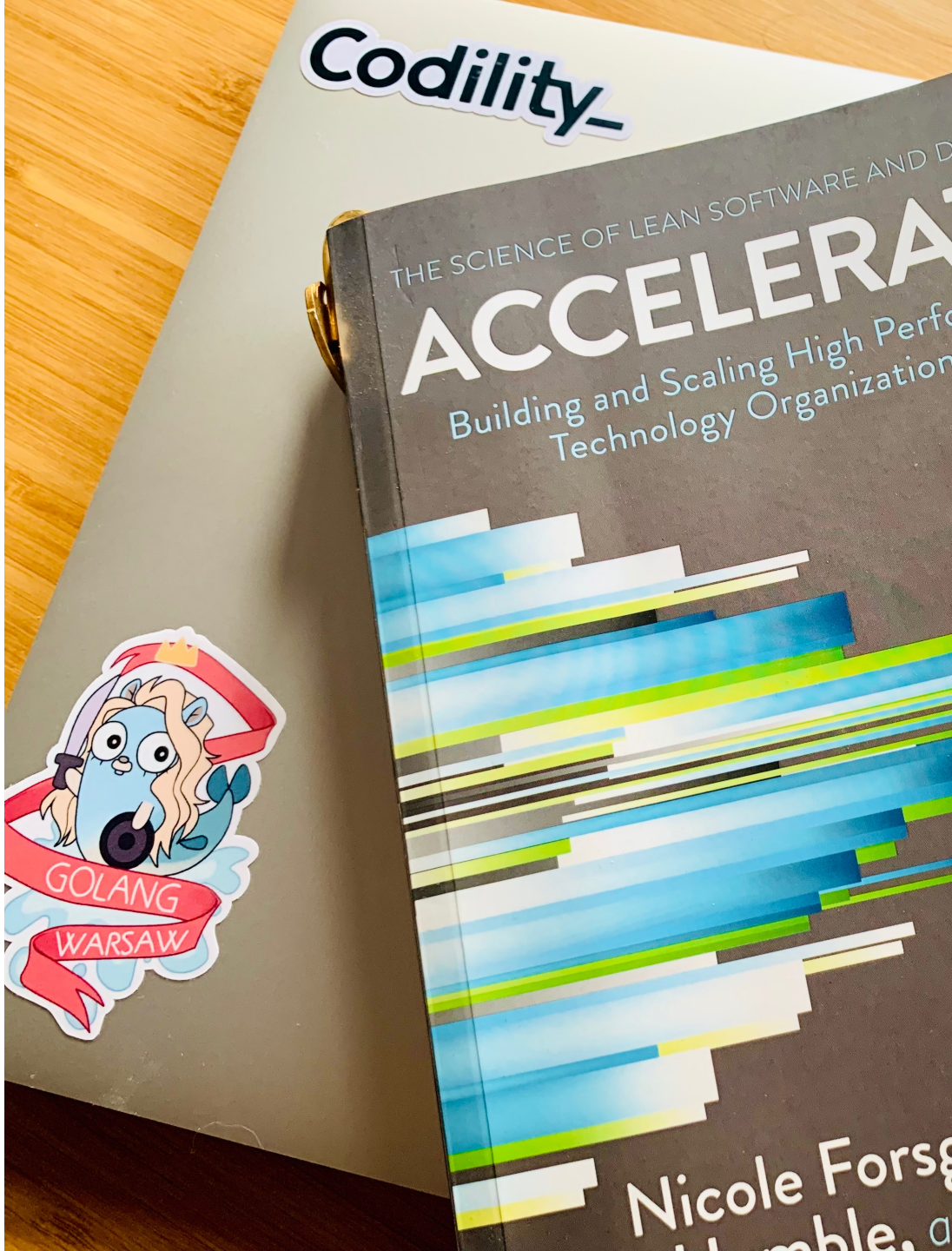
Does my app work?



How to choose the tech?

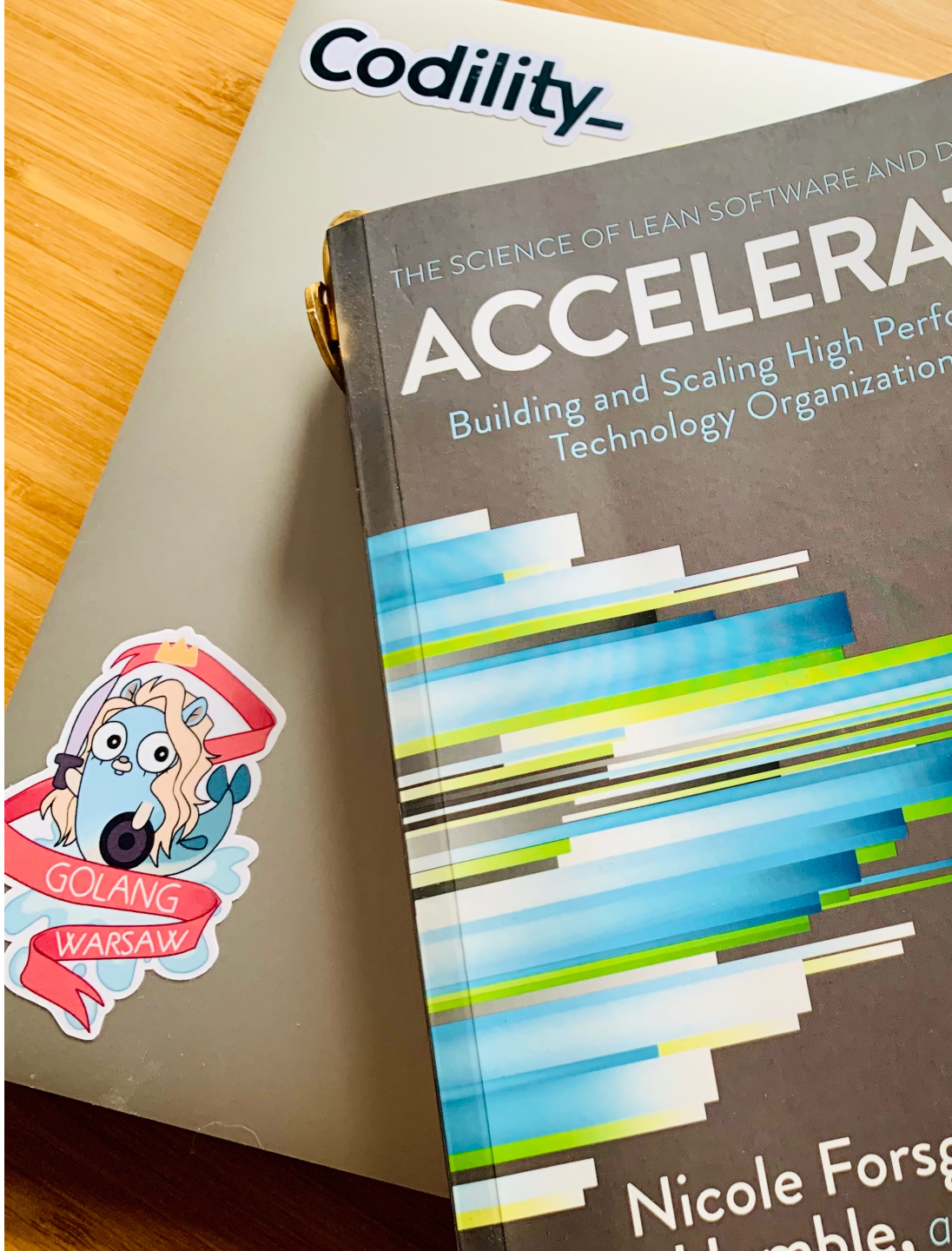
High performance

- Lead Time
- Deployment frequency
- Mean time to Recovery
- Change Fail Percent



High performance

- Commercial success
- ...
- Satisfaction of the employees



Our goal

- Lead time
- Deployment frequency

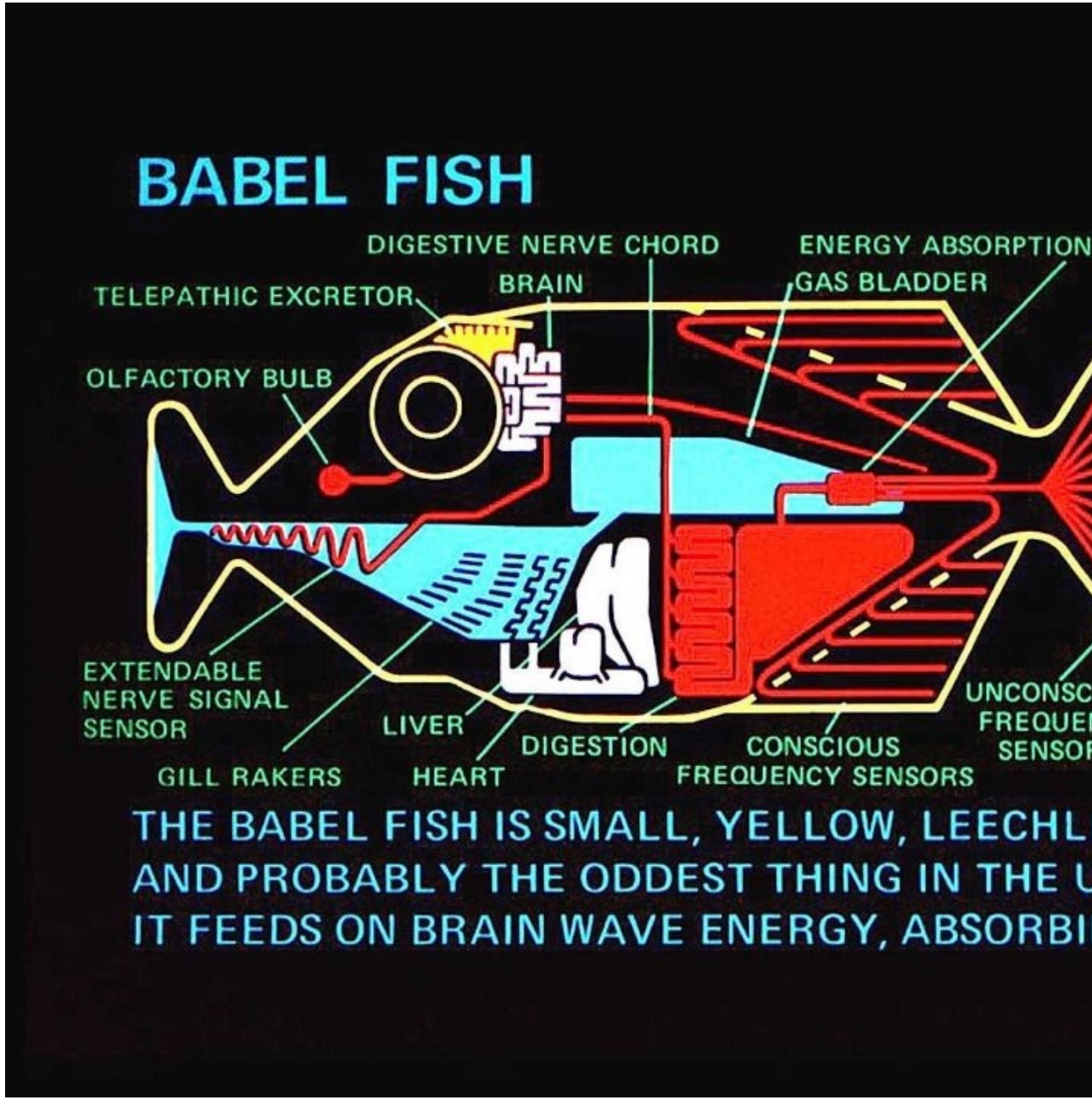
Kubernetes

- Black (Blue) Box
- Almost invisible infrastructure
- Developer in the driving seat

https://en.wikipedia.org/wiki/File:Dr_Who_(316350537).jpg

Kubernetes

- Common language
- Artifacts
- Platform

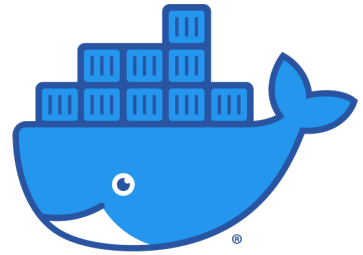


The way of Kubernetes

https://www.flickr.com/photos/bruno_brujah/

- In iterations
- Learn-as-you-go

Docker

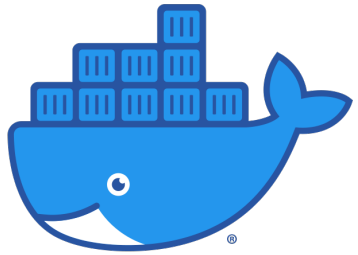


1. Use linters, for example, hadolint
2. Reduce size and numbers of layers:
   .dockerignore && multi-stage

```
RUN apt-get -y update \
        && apt-get install –y vim –no-install-recommended \
        && rm –rf /var/lib/apt/lists/*
```

https://github.com/wojciech12/talk_k8s_what_should_every_dev_know/tree/master/notes_on_learning/02_docker_bestpractises

Docker



3. Do not leave secrets in your Docker
4. Use trivy to scan your Docker images

https://github.com/wojciech12/talk_k8s_what_should_every_dev_know/tree/master/notes_on_learning/02_docker_bestpractises

Manifest generation v1

1. Helm as a templating engine

2. Apply the manifest with your CI/CD pipeline

3. Manual secret creation
   or go with
   secrets-store-csi-driver.sigs.k8s.io

```
deployment_v1
├── Chart.yaml
├── templates
│   ├── configmap.yaml
│   ├── deployment.yaml
│   └── service.yaml
├── values.yaml
├── values_dev.yaml
├── values_prod.yaml
└── values_staging.yaml
```

Manifest generation v1

1. Keep templating to minimal
   YAGNI

2. Generated K8S manifests apply
   on the Kubernetes cluster

3. (alternative) use a transitive repo

```
deployment_v1
├── Chart.yaml
├── templates
│   ├── configmap.yaml
│   ├── deployment.yaml
│   └── service.yaml
├── values.yaml
├── values_dev.yaml
├── values_prod.yaml
└── values_staging.yaml
```

https://github.com/wojciech12/talk_what_I_would_every_dev_know/tree/master/01_app_deployment#steps-in-learning

Manifest generation v2+

Choose your adventure:

- Better secret management
- ArgoCD?
- Deployment strategies
- Dev env on demand

```
deployment_v1
├── Chart.yaml
├── templates
│   ├── configmap.yaml
│   ├── deployment.yaml
│   └── service.yaml
├── values.yaml
├── values_dev.yaml
├── values_prod.yaml
└── values_staging.yaml
```

Manifest generation v2+

- What is a K8S without infrastructure?
- Next - opening Infrastructure-as-a-Code

```
deployment_v1
├── Chart.yaml
├── templates
│   ├── configmap.yaml
│   ├── deployment.yaml
│   └── service.yaml
├── values.yaml
├── values_dev.yaml
├── values_prod.yaml
└── values_staging.yaml
```

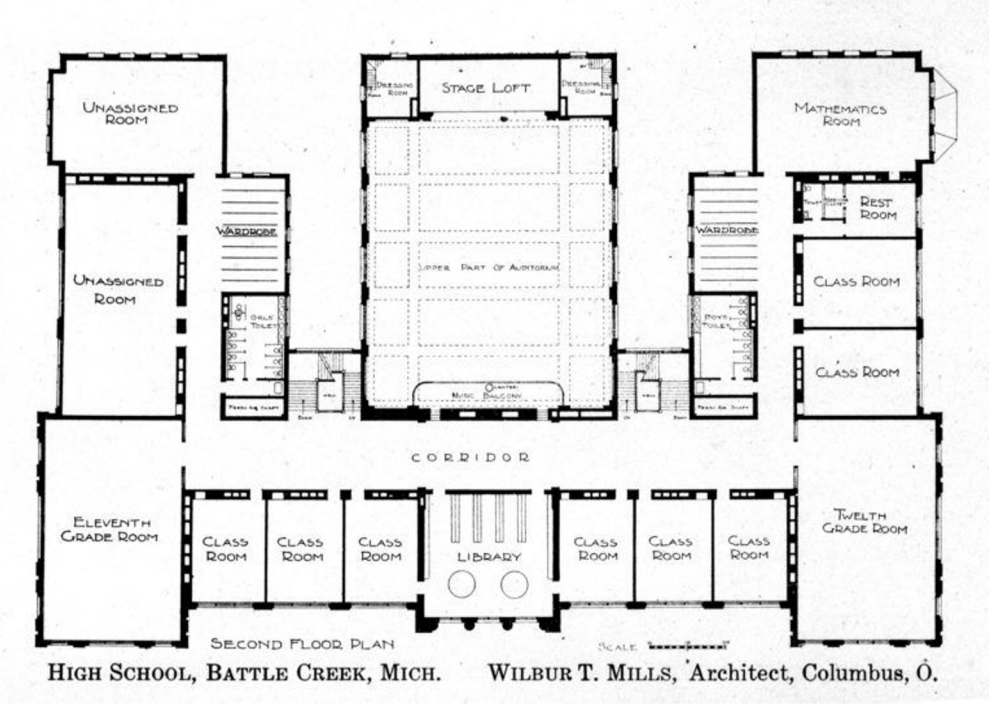
AWS CDK

Kubernetes operators

Conventions over tools

New repository:

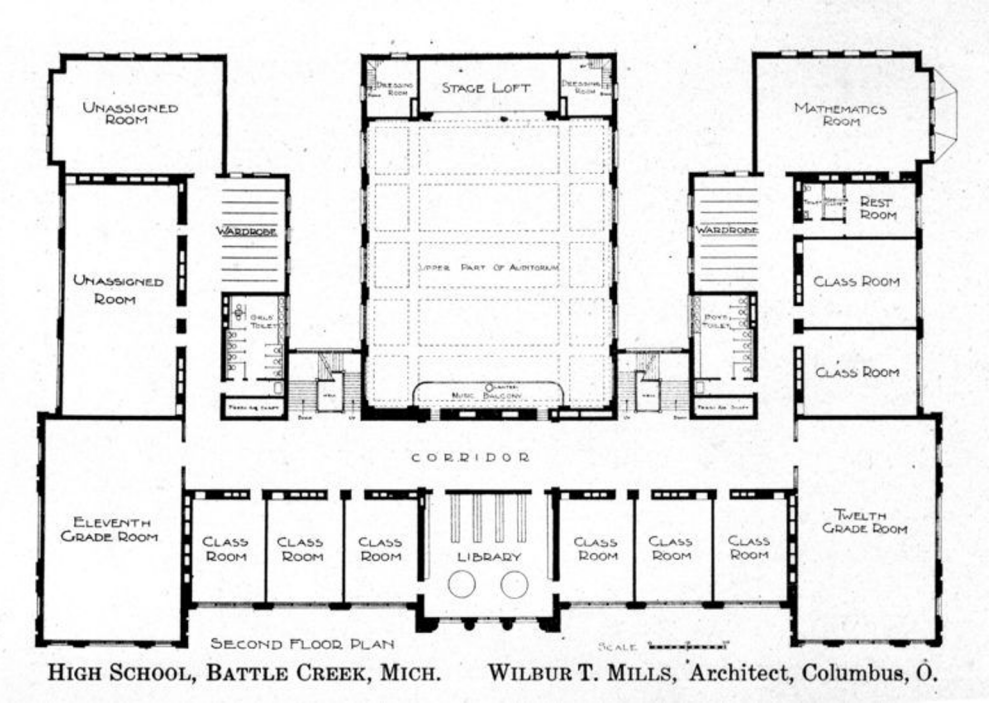
- Generator or copy&paste:
  Makefile, ci.yaml,
  Dockerfile, helm, ...
- Modify few things
- Ready & Go



Conventions over tools

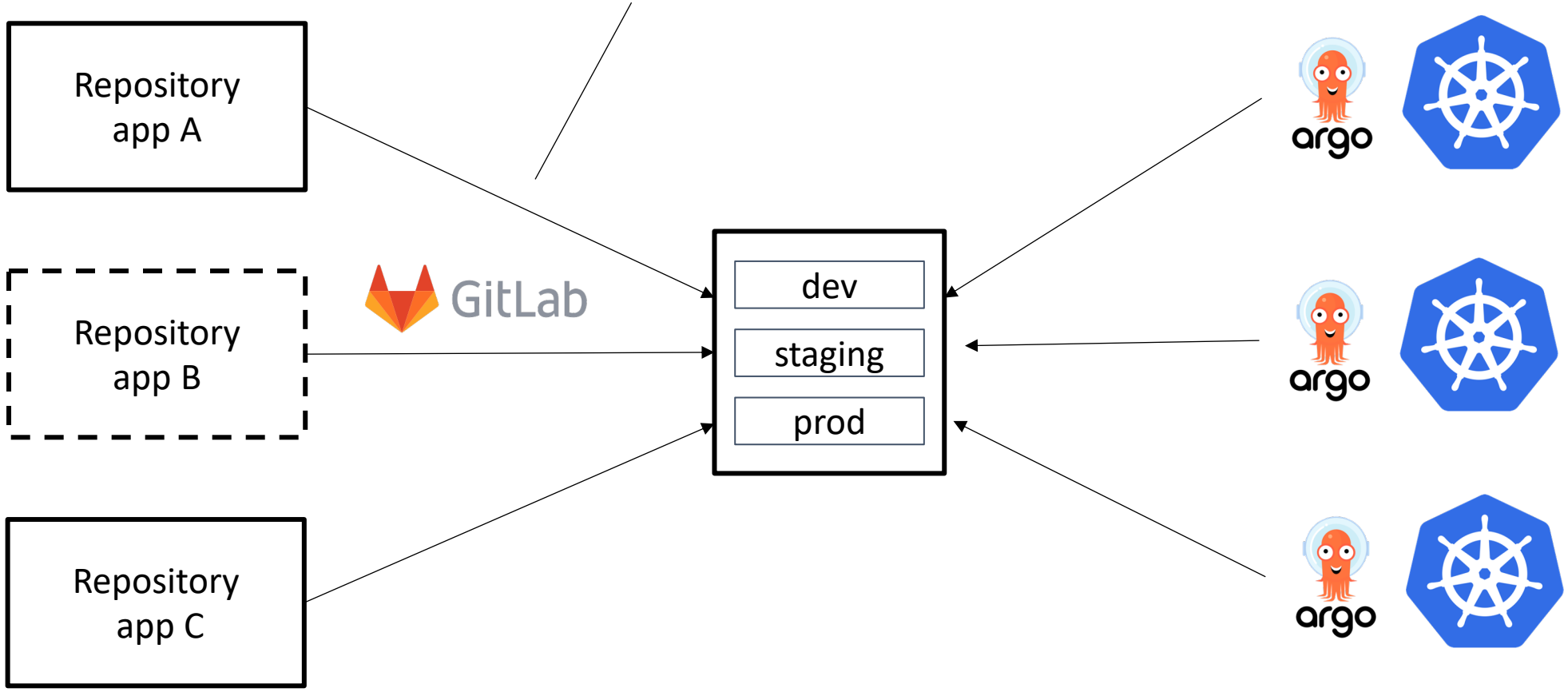
New repository:

- We want people to change the generated code
- We just ask for keeping the common conventions



v1.5

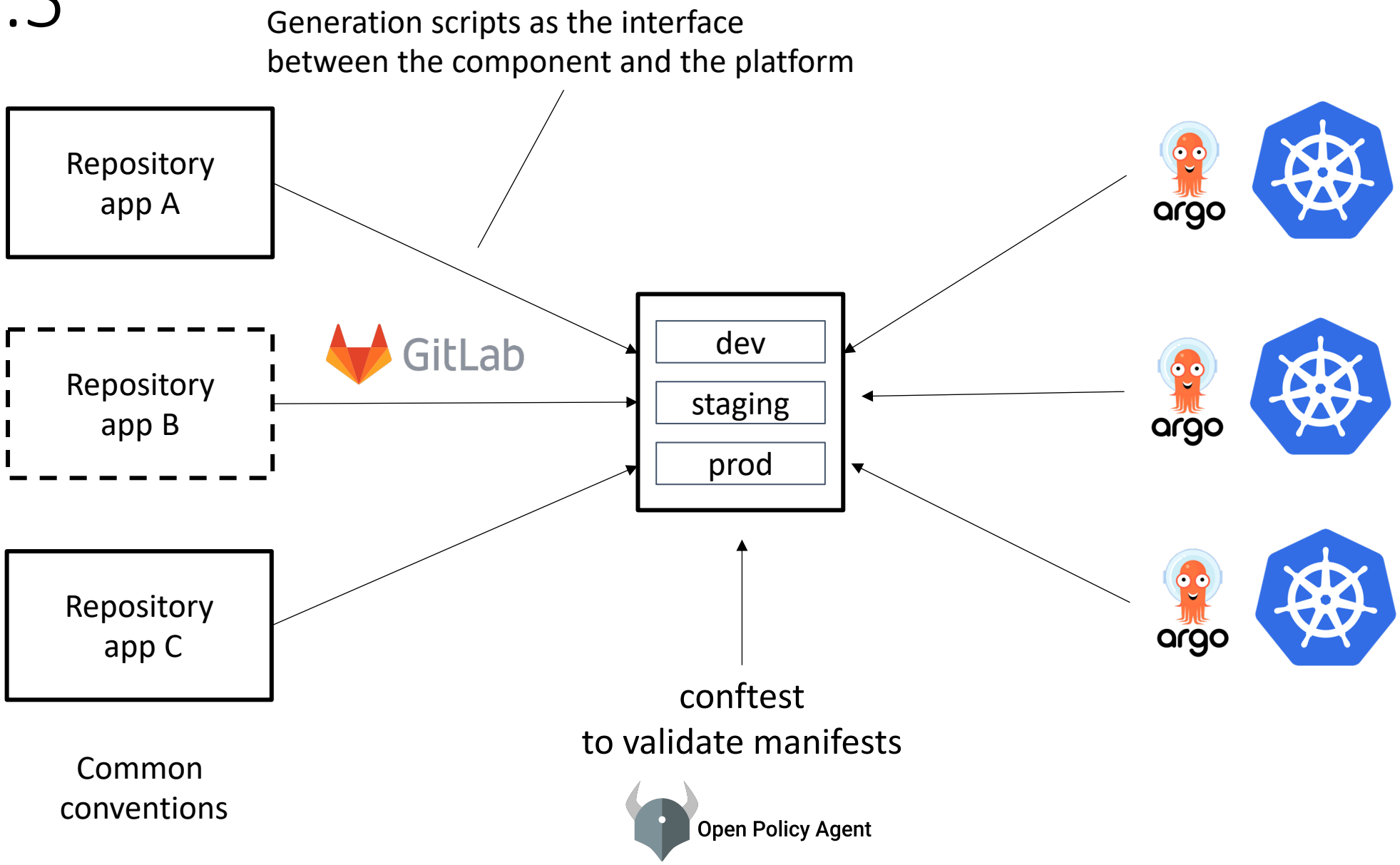
Generation scripts as the interface
between the component and the platform



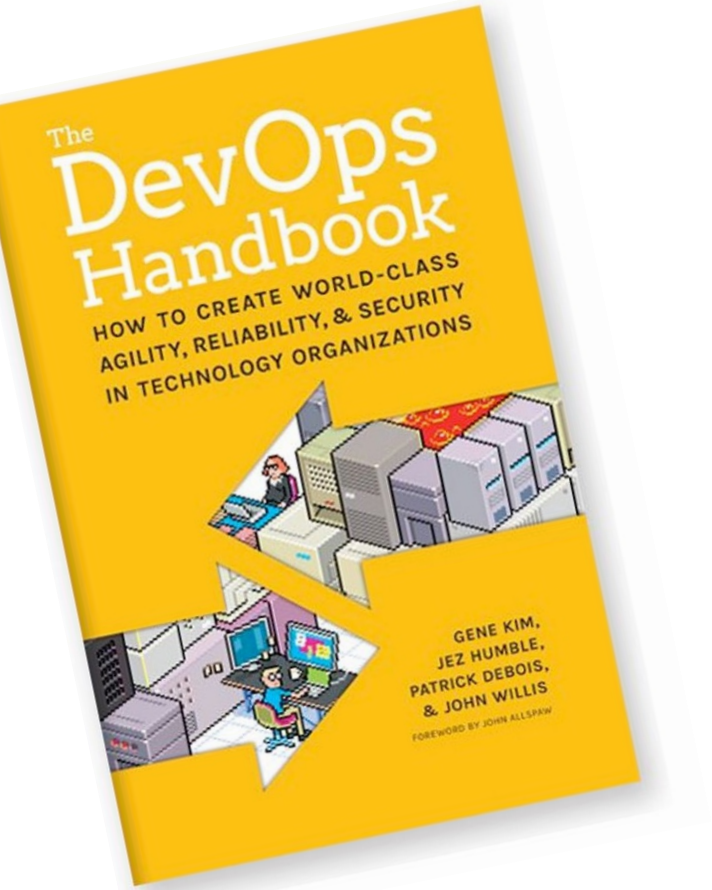
Common
conventions

Transitive repo
with the current cluster
state for every environment.

v1.5

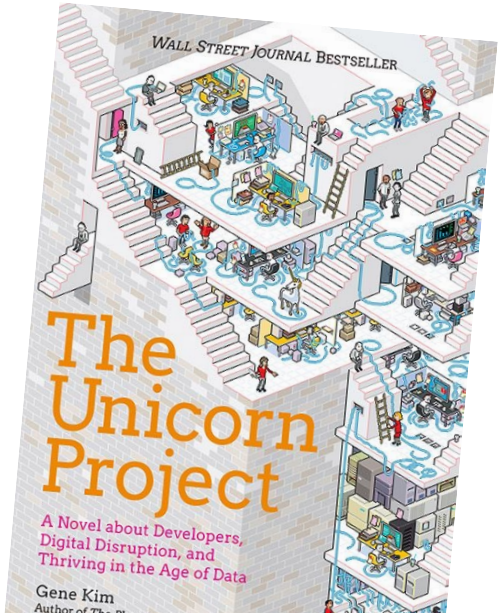

Generation scripts as the interface
between the component and the platform
Repository
app A
Repository
app B
Repository
app C
GitLab
dev
staging
prod
argo
argo
argo
conftest
to validate manifests
Open Policy Agent
Common
conventions

Recommended read



1 Concrete, do A, do B,
because C
(DevOps here as culture, not an admin ☺)

2 The first 4 chapters,
the rest if you have time.



3 A story,
not as straight forward
as (1)

SPACELIFT

Hiring

Golang* developers passionate about system engineering, DevOps culture, or building tools.

* at least 1 year of experience in Golang.

Learn more/apply:
https://grnh.se/9b76ed375us

Questions?

https://www.flickr.com/photos/bruno_brujah/

Backup

Developers

1. Learn basic Kubernetes artifacts and commands
2. CI/CD should take over
3. Common conventions over common tools
4. TBA

Rabbit holes everywhere…

Approach:

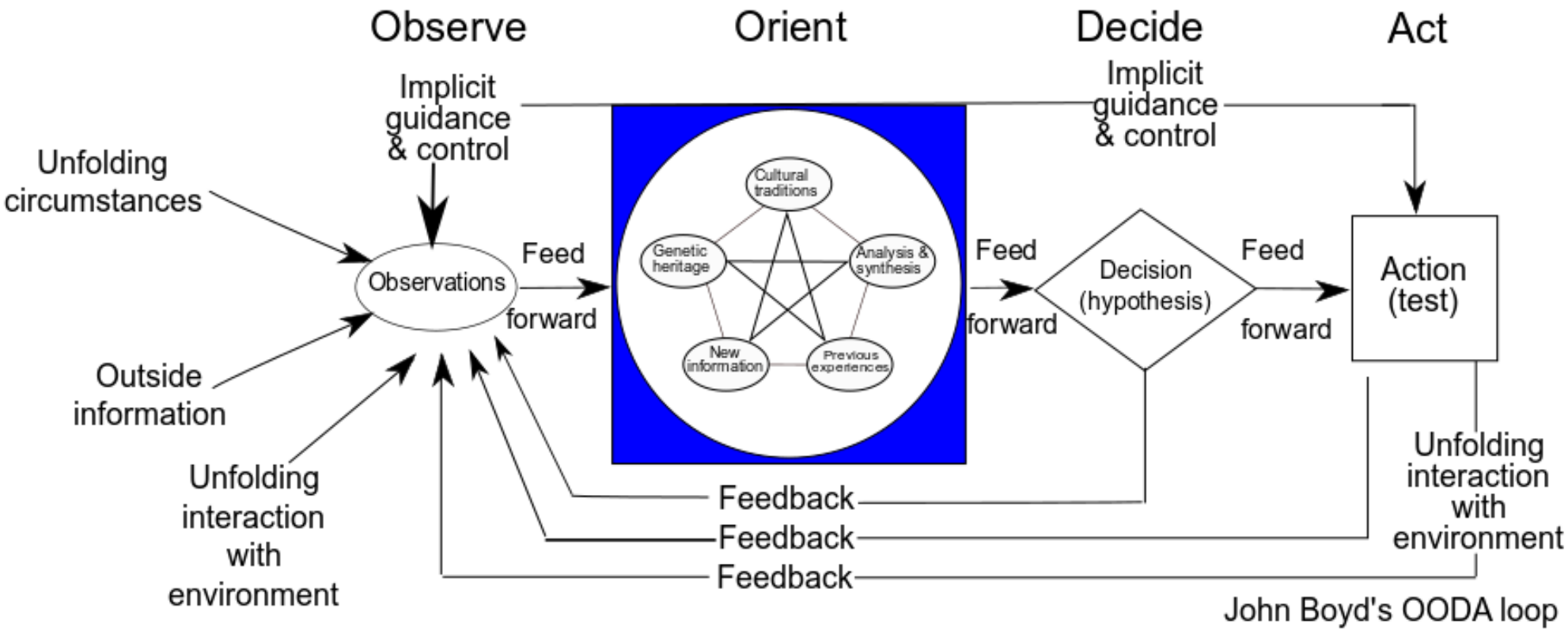
- The iteration, decision, deliver
- As soon as possible
  to get into the cycle Patch Patch Patch

Alternative take:

- Lean v1/v2*

* https://katemats.com/blog/lean-software-development-build-v1s-and-v2s

OODA



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