# With Kubernetes,
# from AWS to Google Cloud Platform.

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# WOJCIECH BARCZYŃSKI

- Senior Software Engineer
  Lead of Warsaw Team - SMACC
- Before:
  System Engineer Lyke
- Before:
  1000+ nodes, 20 data centers with Openstack

# BACKGROUND

- 10+ Developer and R&D
- E-commerce, Artifical Intelligence, Data Centers
- 1.5y with Kubernetes, 3+ AWS, 1+ GCE
  0+ ProfitBricks
- 3.5y with Openstack, 1000+ nodes, 21 data centers
- I do not like INFRA
- I do not like: puppet, chef, ansible,...

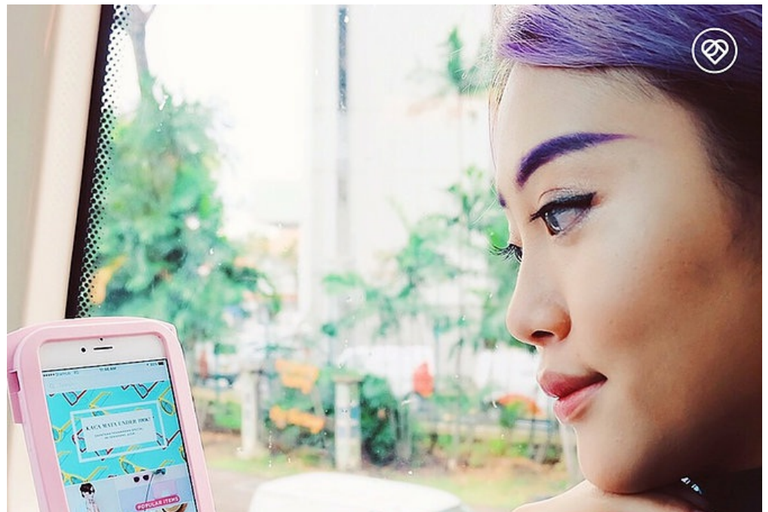
# STORY

- Lyke - [12.2016 - 07.2017]
- SMACC - [10.2017 - present]

LYKE

# LYKE

- E-commerce
- Mobile-only
- 50k+ users
- 2M downloads
- Top 10 Fashion Apps w Google Play Store



# GOOD PARTS

- Fast Growth
- A/B Testing
- Data-driven
- Product Manager,
  UI Designer,
  Mobile Dev,
  and tester - one body

## CHALLENGES 12.2016

- 50+ VMs in Amazon, 1 VM - 1 App, idle machine
- Puppet, hilarious (manual) deployment process
- fear
- forgotten components
- sometimes performance issues

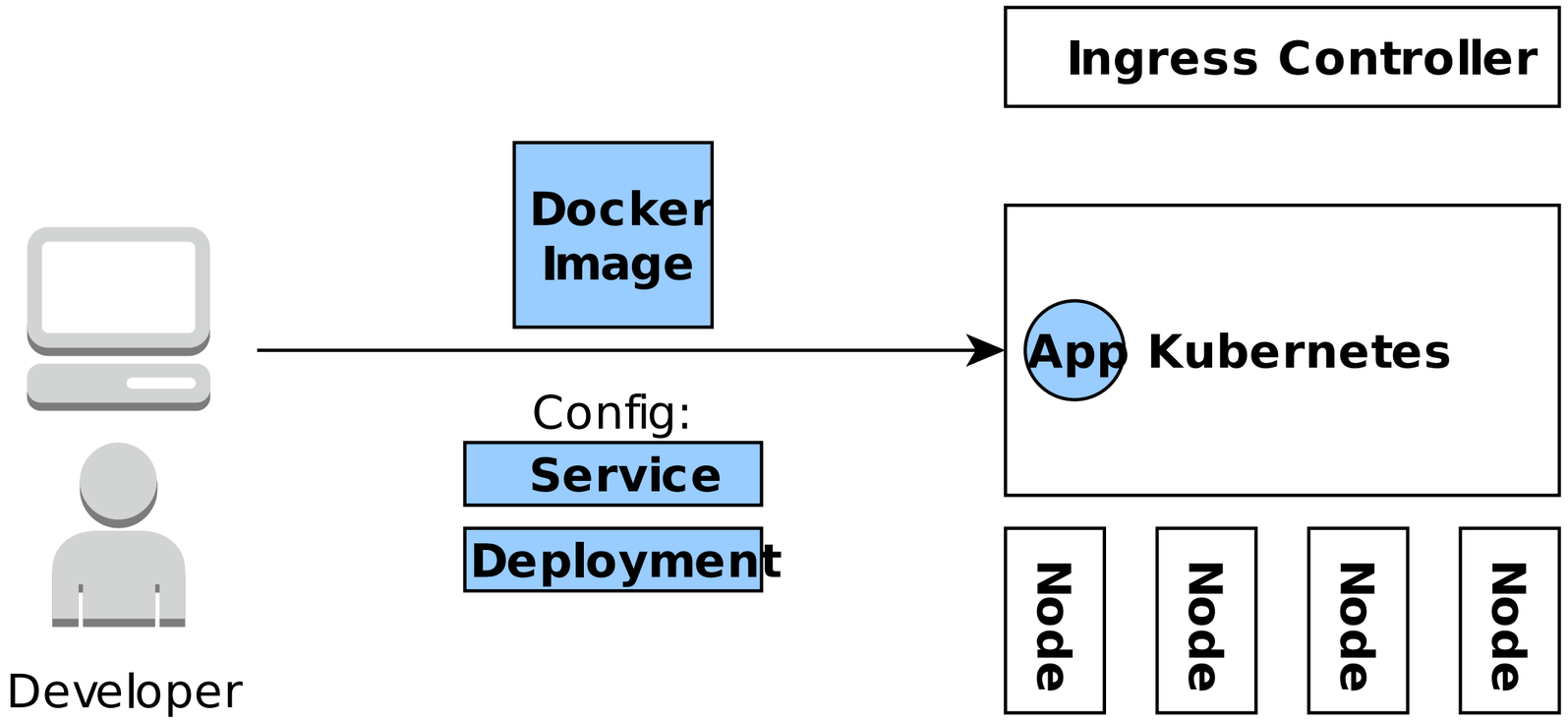
## APPROACH

1. Simplify infrastructure
2. Change the Development practices
3. Change the work organization

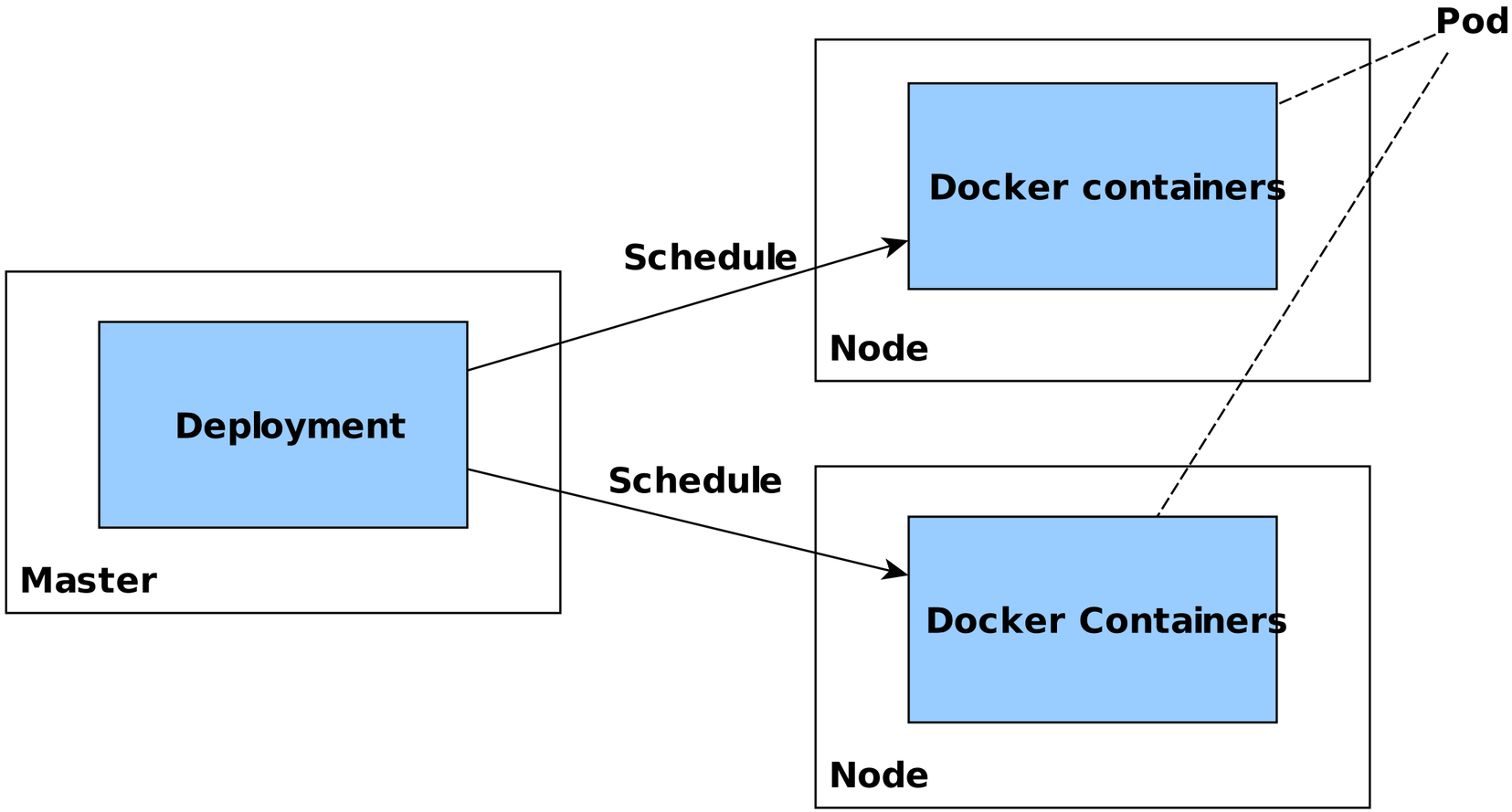
# WHY KUBERENTES

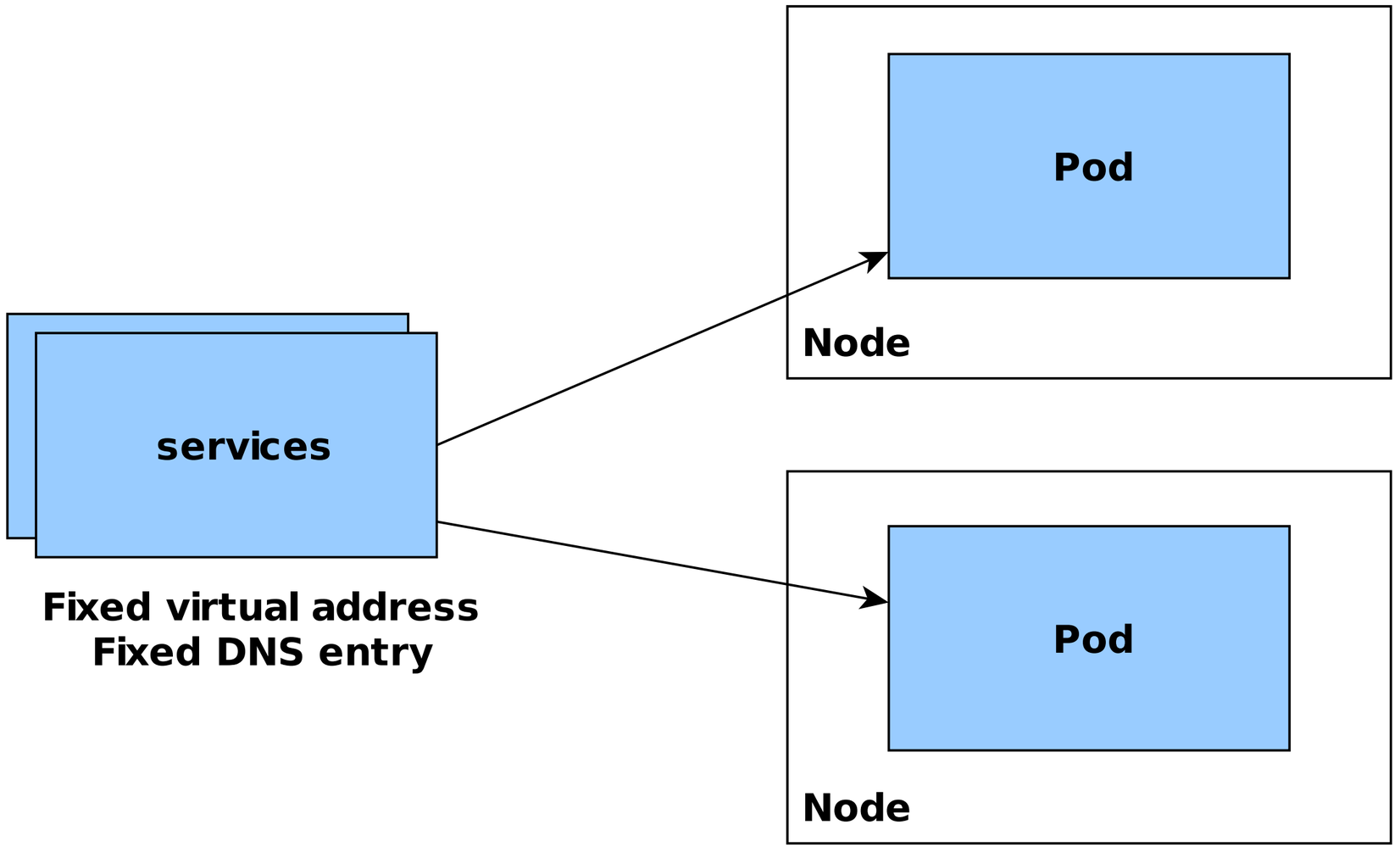
- Data center as a black-box
- Simple Semantic
- Batteries for your 12factor apps
- Meta-data support
- Service discovery
- Cloud-Provider independent, we can always move

# KUBERNETES



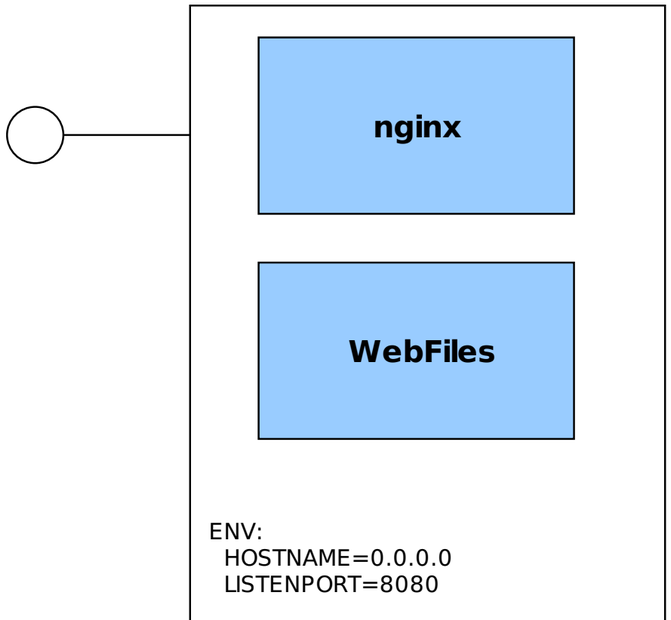

```
make docker_push; kubectl create -f app-srv-dpl.yaml
```


Pod
Docker containers
Schedule
Node
Deployment
Schedule
Master
Docker Containers
Node

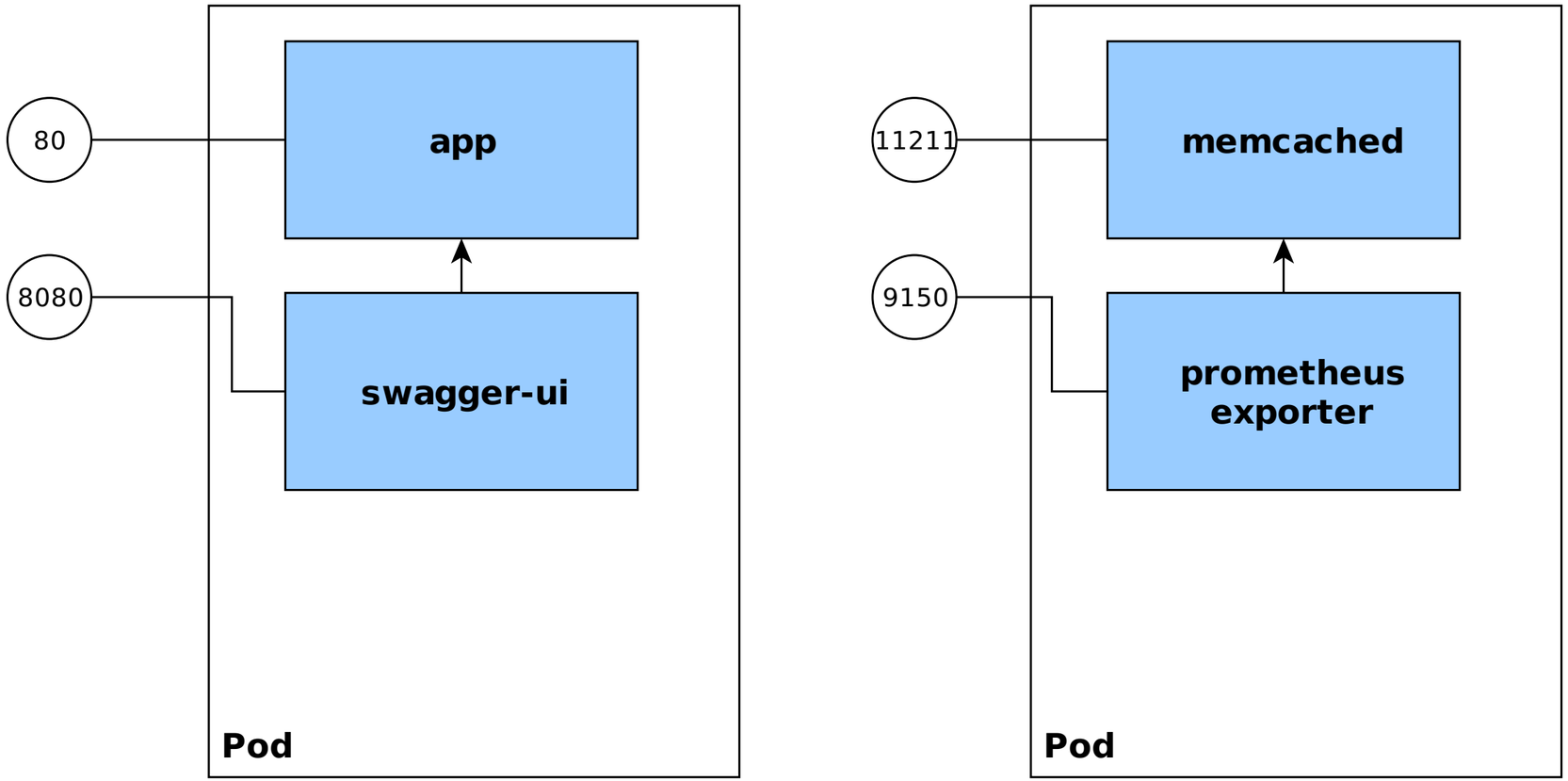

Pod
Node
services
Fixed virtual address
Fixed DNS entry
Pod
Node

# PODS

- See each other on localhost
- Live and die together
- Can expose multiple ports



# SIDE-CARS


80
app
8080
swagger-ui
Pod
11211
memcached
9150
prometheus
exporter
Pod

# BASIC CONCEPTS

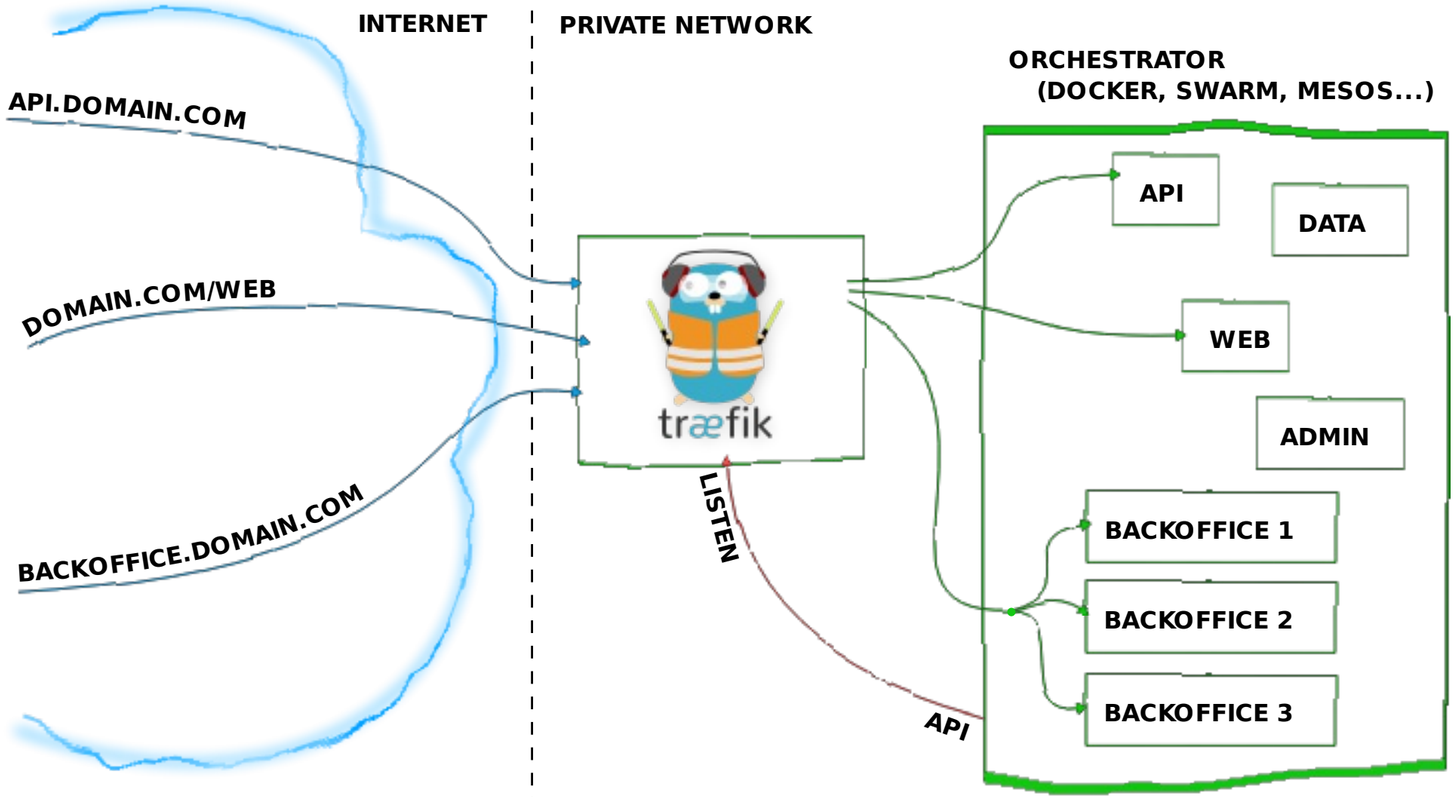
| Name | Purpose | |
|---|---|---|
| Service | Interface | Entry point (Service Name) |
| Deployment | Factory | How many pods, which pods |
| Pod | Implementation | 1+ docker running |

# INGRESS CONTROLLER

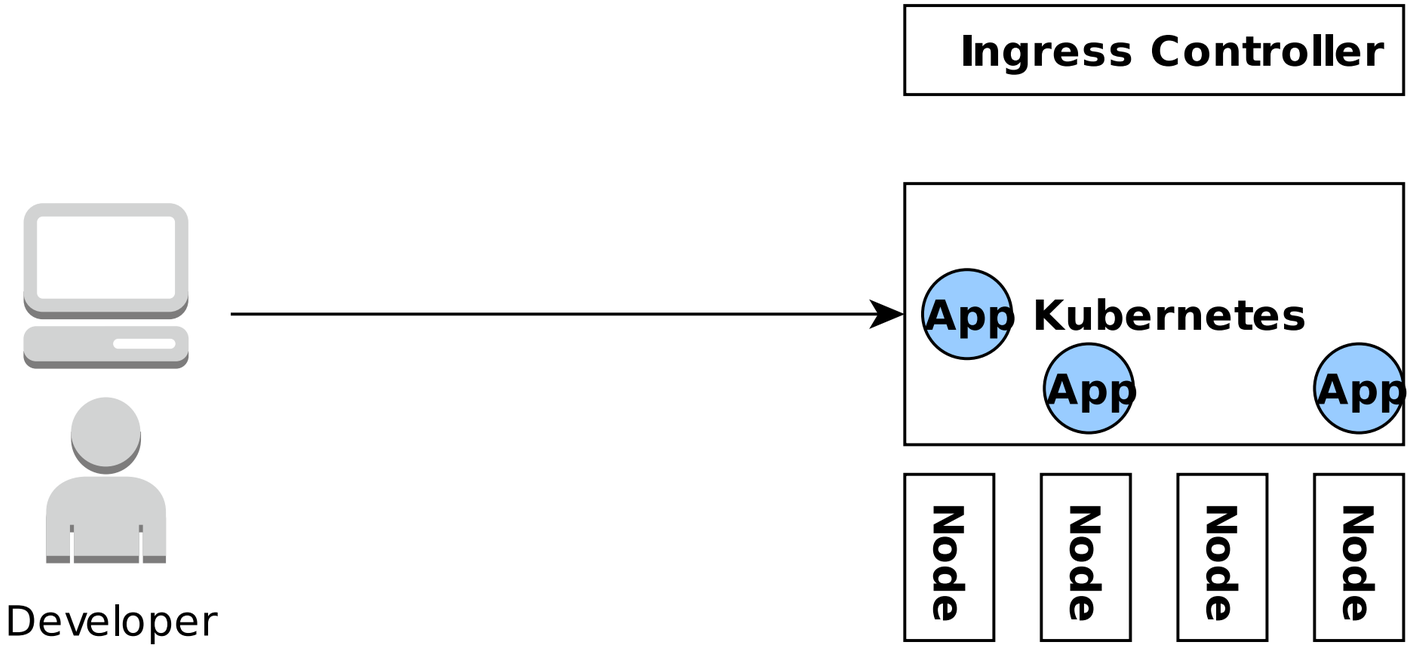
- api.x.ee/v2/users ➡ service: users-v2:80
- api.x.ee/v2/users/swagger-ui
  ➡ service: users-v2:8080
- api.x.ee ➡ service: website

Every service can have its own ingress config.

# INGRESS CONTROLLER

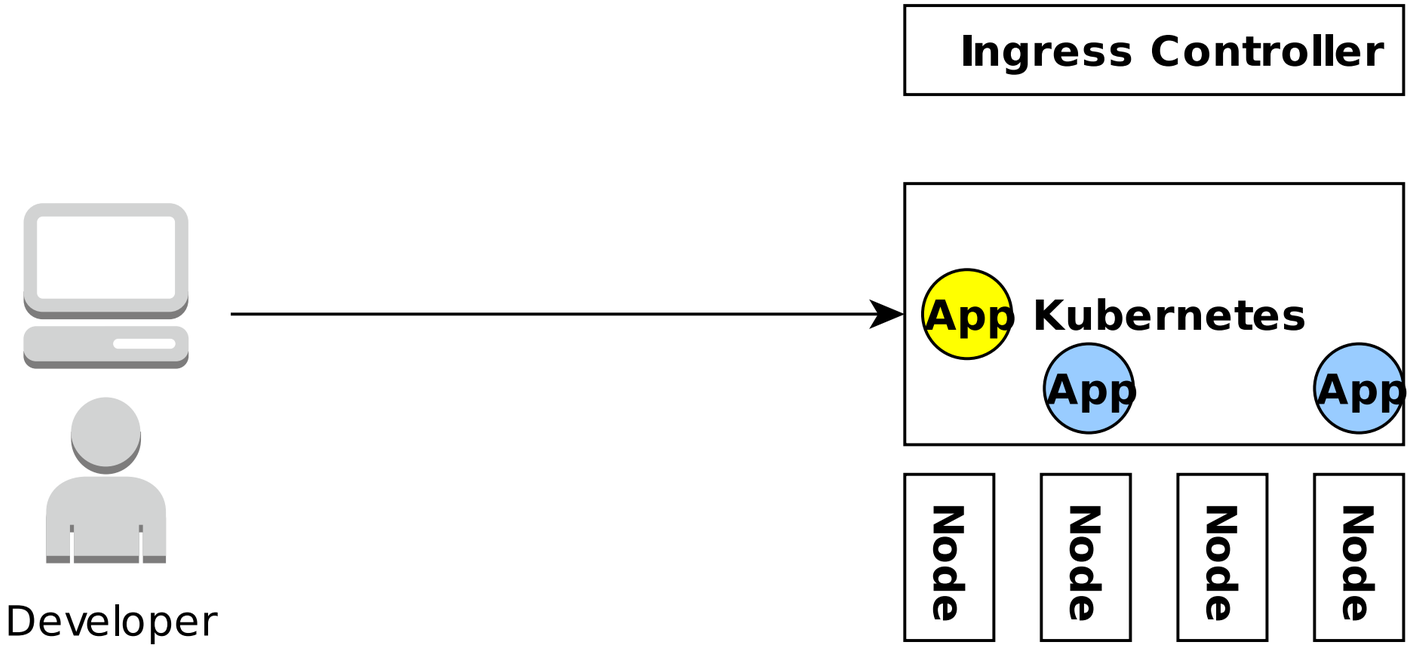


# SCALING



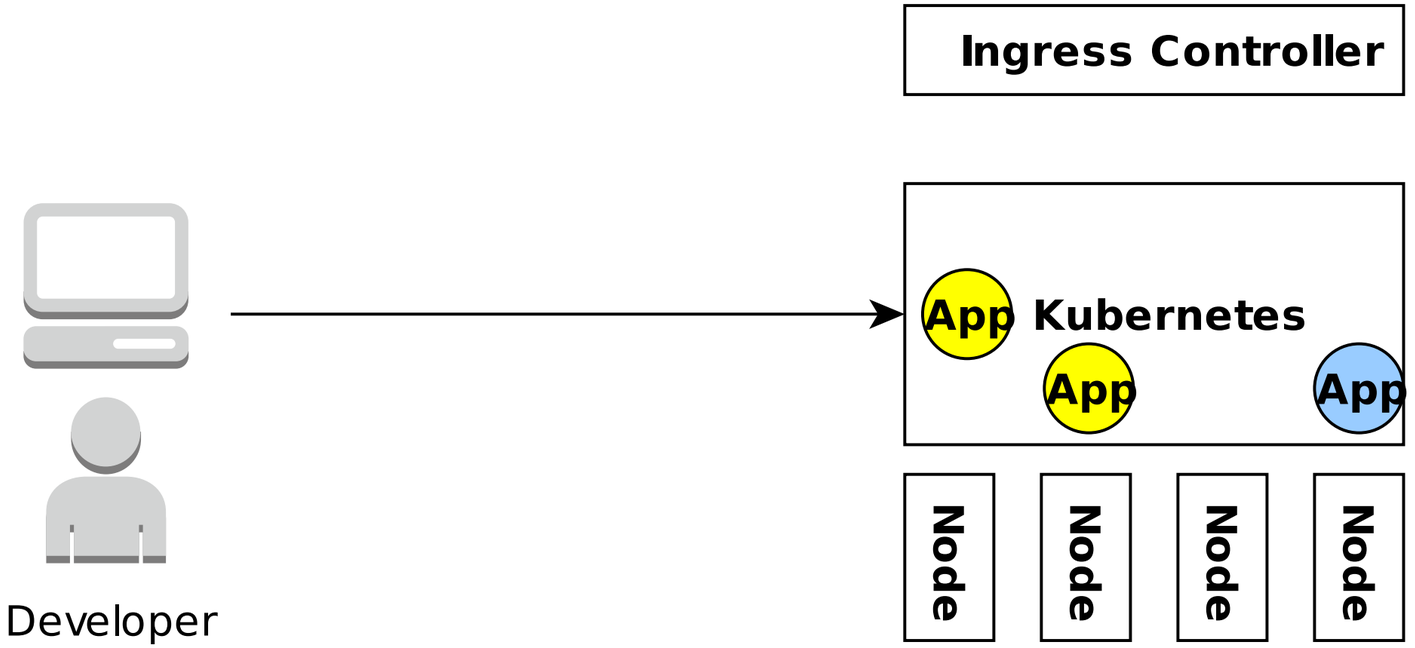

```
kubectl scale --replicas=3 -f app-srv-dpl.yaml
```

# ROLLING RELEASE



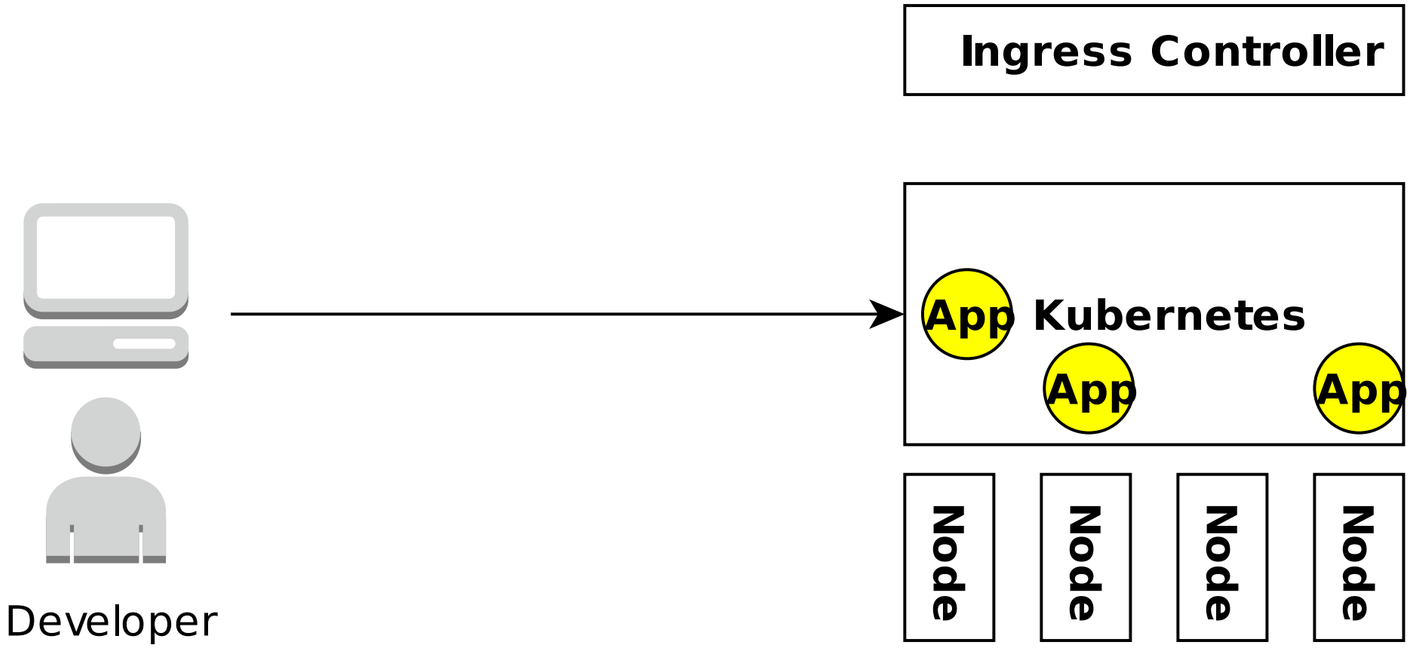

```
kubectl set image deployment/app app=app:v2.0.0
```

# ROLLING RELEASE




```
kubectl set image deployment/app app=app:v2.0.0
```

# ROLLING RELEASE




```
kubectl set image deployment/app app=app:v2.0.0
```

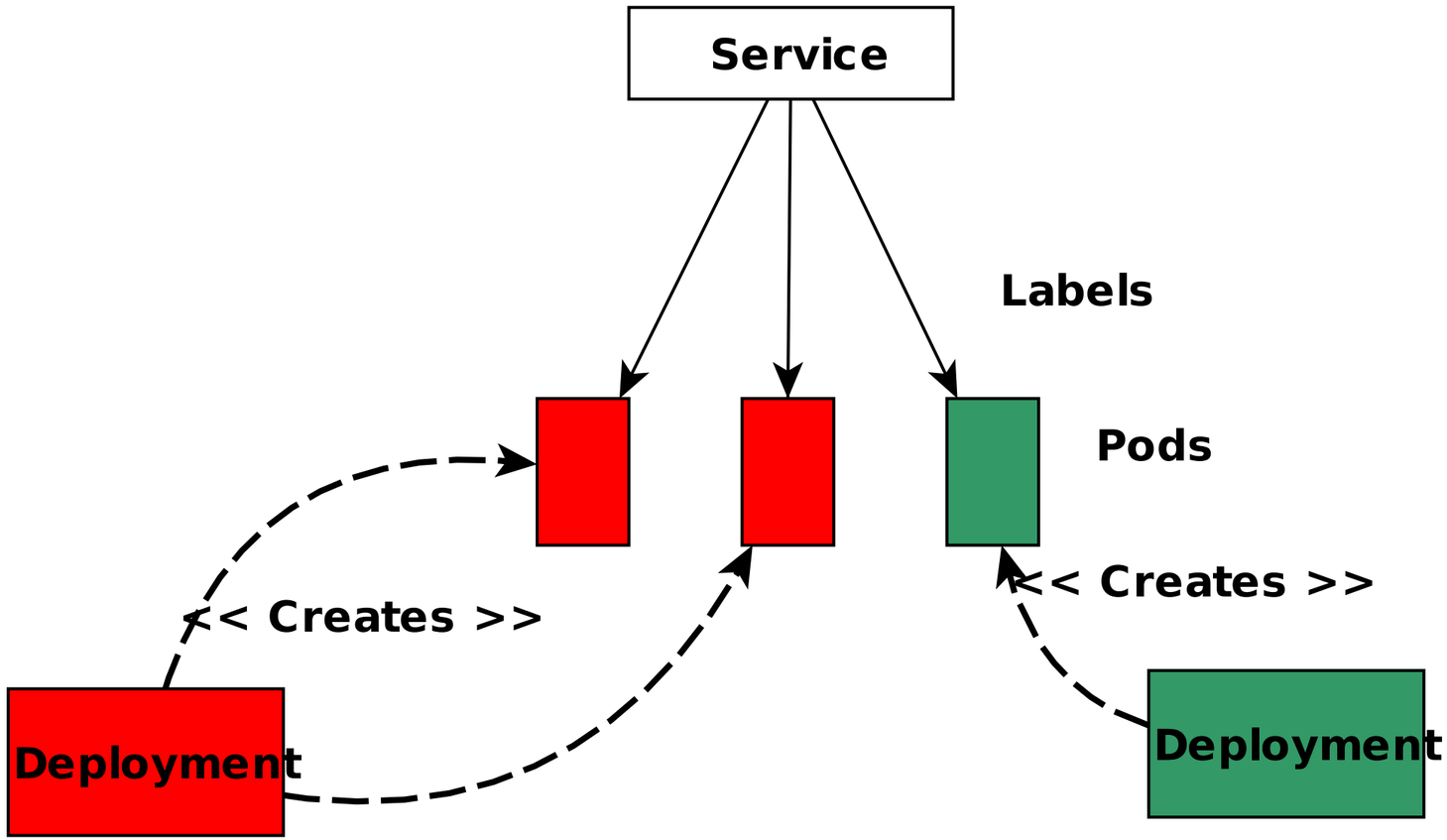
# ROLLING RELEASE

We used:

- Basic Rolling Releases per Component (focus on simplicity)
- A/B switches in Mobile App with Google Firebase

BlueGreen Deployment - ingress controller

# ROLLING RELEASE WITH DEPLOYMENTS




Also possible

# THE BEST PART

All the code lives in your git:

- integration with monitoring, alarming
- integration with ingress-controller
- smoke tests
- ...
- Devs can foget about infrastructure... almost
- Happy developers! ☺

DevOps Culture Dream!

# INGRESS RULE PER COMPONENT

`cat tools/ingress-production.yaml`

```
---
apiVersion: extensions/v1beta1
kind: Ingress
metadata:
  name: api-status
  namespace: production
  annotations:
    kubernetes.io/ingress.class: traefik
spec:
  rules:
  - host: api.example.com
    http:
      paths:
        - path: /status
          backend:
```

# INTEGRATION WITH PROMETHEUS

`cat memcached-0-service.yaml`

```
---
apiVersion: v1
kind: Service
metadata:
  name: memcached-0
  labels:
    app: memcached
    kubernetes.io/name: "memcached"
    role: shard-0
  annotations:
    prometheus.io/scrape: "true"
    prometheus.io/scheme: "http"
    prometheus.io/path: "metrics"
    prometheus.io/port: "9150"
spec:
```

https://github.com/skarab7/kubernetes-memcached

# USE LABELS IN ALERT RULES

```
ALERT ProductionAppServiceInstanceDown
  IF up { environment = "production", app =~ ".+"} == 0
  FOR 4m
  ANNOTATIONS {
      summary = "Instance of {{$labels.app}} is down",
      description = " Instance  {{$labels.instance}} of app {{$labels.app}}
  }
```

AlertManager

# USE LABELS IN ALERT ROUTING

Call somebody if the label is `severity=page`:

```
---
 group_by: [cluster]
 # If an alert isn't caught by a route, send it to the pager.
 receiver: team-pager
 routes:
  - match:
      severity: page
    receiver: team-pager

receivers:
- name: team-pager
  opsgenie_configs:
  - api_key: $API_KEY
    teams: example_team
```

AlertManager

# SIMPLIFY

- Google Identity-Aware-Proxy to protect all dashboards

# INFRA REPO

Terraform:

- Prometheus
- Grafana
- Centralized logging - EFK
- DNS entries
- Setup 3rd party, e.g., OpsGenie and StatusCake

# INFRA REPO

Config files:

- alertManager rules
- alertManager routing
- graph definitions

# INFRA REPO

Extras:

- TF for Google Identity-Aware-Proxy [*]
- external services pointing to AWS instances with `kubectl`

[*] Setting up LB and Health-Checks

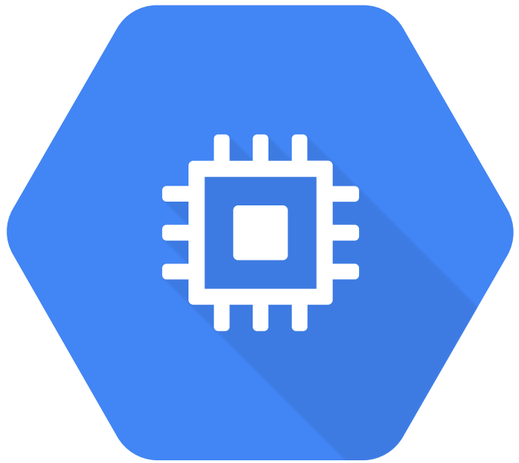
# SUM UP

1. Kubectl and Kubernetes config files [*]
2. Terraform for the rest
3. Gopass for sharing secrets and configs

[*] some components still needed manual intervention

# GOOGLE CONTAINER ENGINE

- Managed k8s
- Integrated with Google Cloud
- Identity-Aware Proxy
- Google 2-factor auth



## MANAGED

- Painless (1-2 second off-line) upgrades
- Scale-up and Scale-down
- No need to login to the nodes
- Google Docker Repository with no surprises

## INTEGRATION

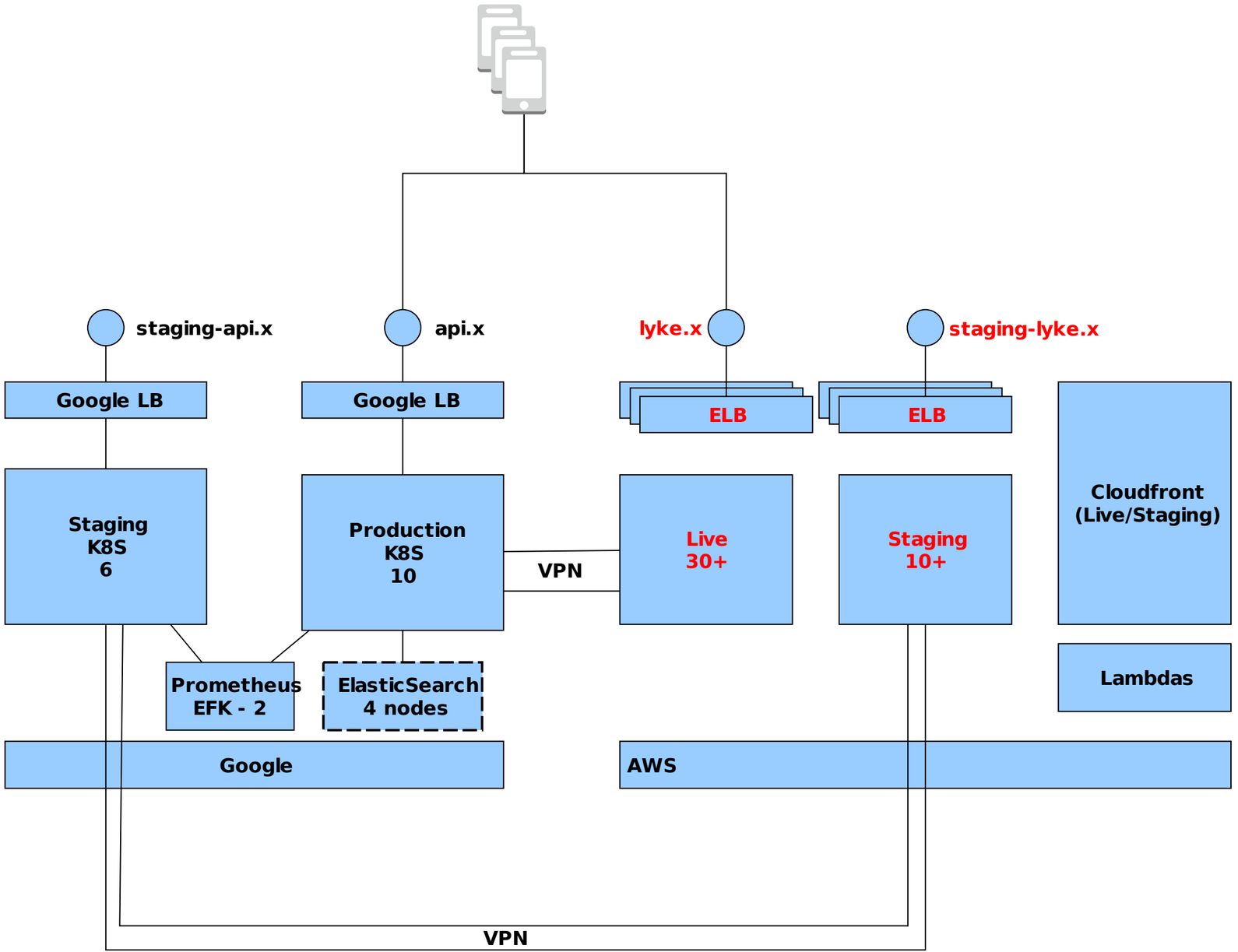
- Load-Balancer and Health-checks
- Persistent volumes
- Graphic-card support added
- Sane Service accounts for CD and CI

# OUR FINAL SETUP

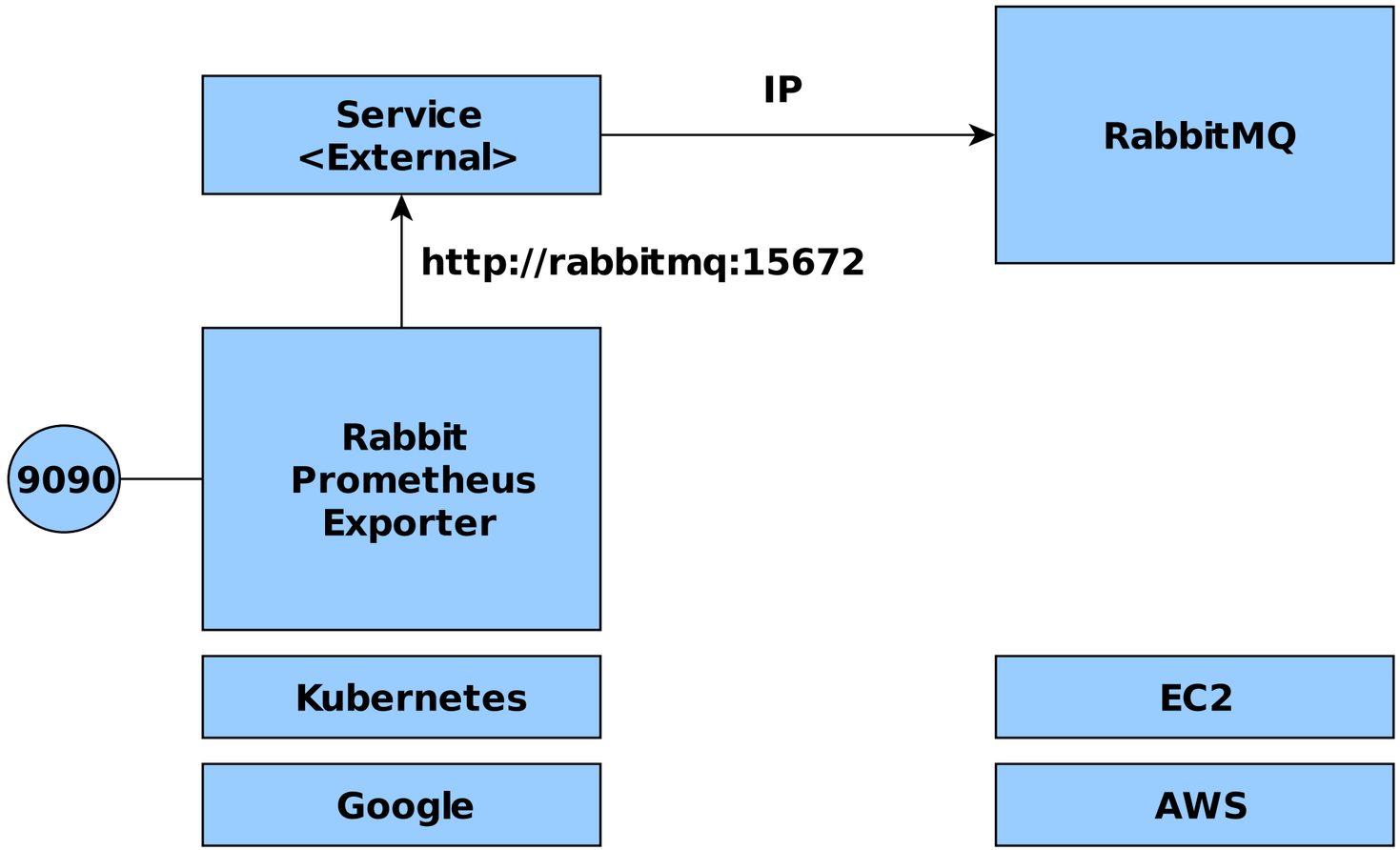
- 2 clusters: staging and production
- use Google Database [*]
- instance for Prometheus+AlertManager and EFK
- 3rd parties: Opsgenie and StatusCake
- Still use AWS components: Lambda and Cloudfront

[*] was planned

# Architecture During Migration



# NEW WITH OLD


Service
<External>
IP
RabbitMQ
http://rabbitmq:15672
9090
Rabbit
Prometheus
Exporter
Kubernetes
EC2
Google
AWS

# OLD WITH NEW

- Ad-hoc
- DNS entries to nodes
- Some talking over (secured) public endpoints

I wish I introduced HashiCorp Consul earlier

# CHANGE THE DEVELOPMENT PRACTICES

See Conway's law

# 1. CLEAN UP

- Single script for repo - Makefile [1]
- Resurrect the README

[1] With zsh or bash auto-completion plugin in your terminal.

# 2. GET BACK ALL THE KNOWLEDGE

- Puppet, Chef, ... ➡ Dockerfile
- Check the instances ➡ Dockerfile, README.rst
- Nagios, ... ➡ README.rst, `checks/`

# 3. INTRODUCE RUN_LOCAL

- `make run_local`
- A nice section on how to run in README.rst
- Use: `docker-compose`

The most crucial point.

# 4. GET TO KUBERNETES

- `make kube_create_config`
- `make kube_apply`
- Generate the yaml files if your envs differ

# 5. CONTINUOUS DEPLOYMENT

Travis:

- test code, build docker, push to docker repo
- only run the rolling update:
  `kubectl set image deployment/api-status nginx=nginx:1.9.1`
- did not create any kubernetes artificats [*]

[*]

# 6. KEEP IT RUNNING

Bridge the new with old:

- Use external services in Kubernetes
- Add Kubernetes services to your Service Discovery [1]

[1] I evaluated feeding K8S events to HashiCorp consul

# 7. INTRODUCE SMOKE-TEST

```
TARGET_URL=127.0.0 make smoke_test
TARGET_URL=api.example.com/users make smoke_test
```

# 8. GOT FIRST MICRO-SERVICES

To offload the biggest components:

- Keep the light on of the old components
- New functionality delegated to micro-services

# 9. GET PERFORMANCE TESTING

- introduce wrk for evaluating performance (more like a check for dockers)
- load test the real system

# SERVICE SELF-CONSCIOUSNESS

Add to old services:

1. *metrics/*
2. *health/*
3. *info/*
4. *alertrules/ - PoC*

# CHANGE THE WORK ORGANIZATION

- From Scrum
- To Kanban

For the next talk

## WHAT I WOULD DO DIFFERENT

- More aggressive getting k8s components running in production
- Cut all PoC to 2 weeks max (consul, Vault, Hydra,...)
- Introduce HashiCorp in the old stack first
- Migrate the data to Google Mysql earlier

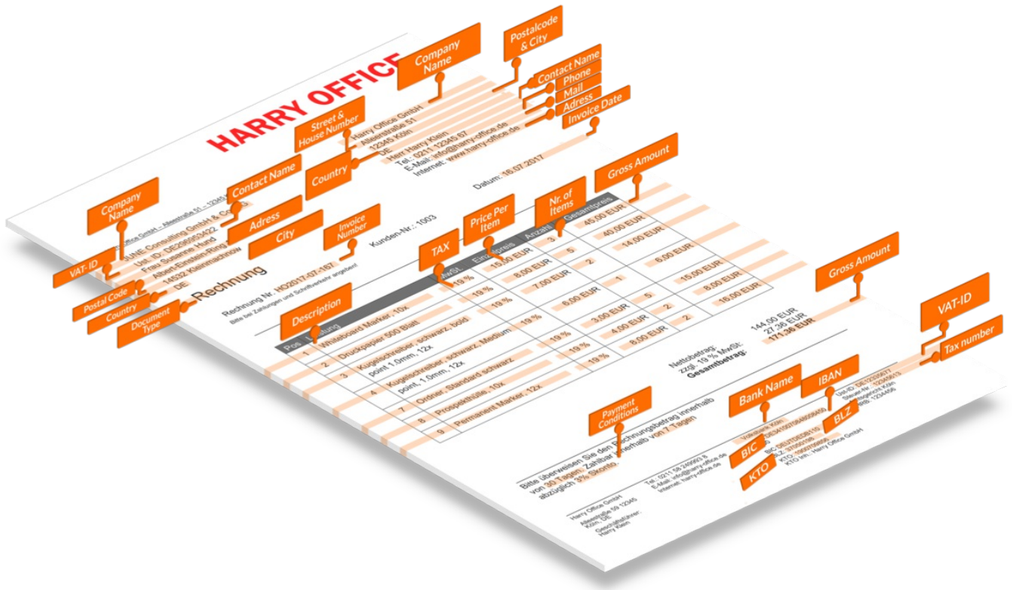
## BUILDING NEW SYSTEMS

- Ability to replicate user traffic


SMACC

# SMACC

- End-to-end Automation of Accounting
- Recognized AI FinTech Startup in Germany
- https://www.smacc.io/en/



# GREAT POINTS

- Strong AI and Data Science Team
- Deep know how on accounting and finance processes
- a lot of tested code, strong engineering

# CHALLENGE

- Before noneed for strong System Engineering
- Initial experiment with ECS, not amazing
- Few monolith oversized components
- Business Pressure on choosing a EU cloud provider
- Customers at the gates!

# KUBERNETES

- OAuth2 from Azure DS
- TravisCI for Continuous Deployment
- ProfitBrikcs S3
- Databases as separate nodes

# PROFITBRICKS

- Terraform provider [X]
- Basic Load Balancing (layer 3) [X]
- DE [X]
- Thanks to Kubernetes, we can eaily move to Amazon EKS, Google CE, or Azure Kubernetes if needed

# NEXT STEPS

- Building new services around the core AI product
- Tech-debt in check, we can focus on building an effective (modern) architecture
- Evaluating new: linkerd.io, istio.io
- missy - an auto-wiring microservice Open Source framework to forge our lesson-learnt into code (more on that next year :) )

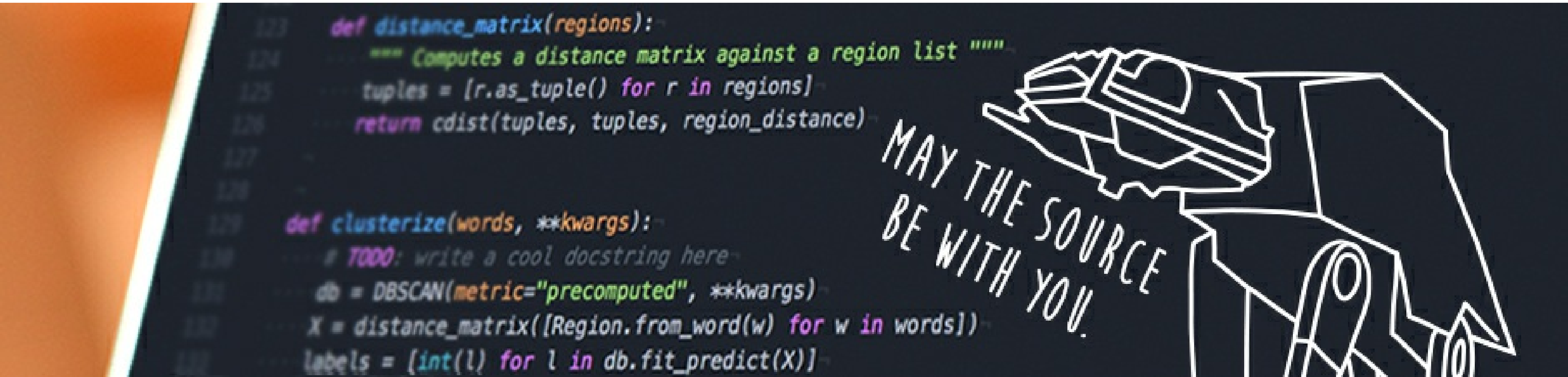
# NEXT STEPS

- More on our platfrom and OpenSource projects in one of the next meetups

# SUMMARY

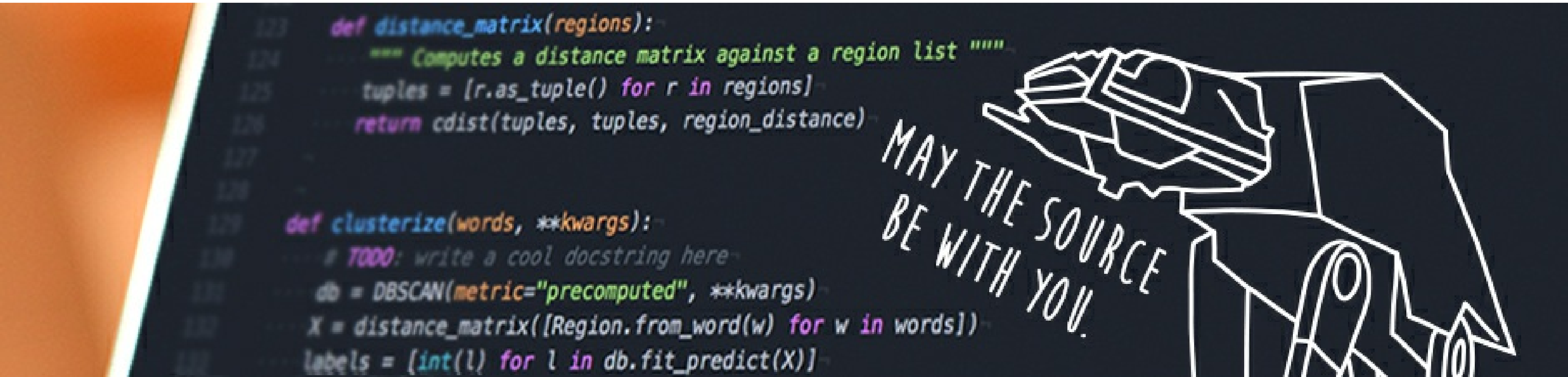
- Changes happens: Single point of entry, README.rst
- Kubernetes is the new Linux!
- Less important your cloud provider
- RAFT... CAP... in the end it is about people

# THANK YOU


def distance_matrix(regions):
""" Computes a distance matrix against a region list """
tuples = [r.as_tuple() for r in regions]
return cdist(tuples, tuples, region_distance)
def clusterize(words, **kwargs):
# TODO: write a cool docstring here
db = DBSCAN(metric="precomputed", **kwargs)
X = distance_matrix([Region.from_word(w) for w in words])
labels = [int(l) for l in db.fit_predict(X)]
MAY THE SOURCE
BE WITH YOU.

From our developers, Warsaw Office in BL Astoria:

# QUESTIONS?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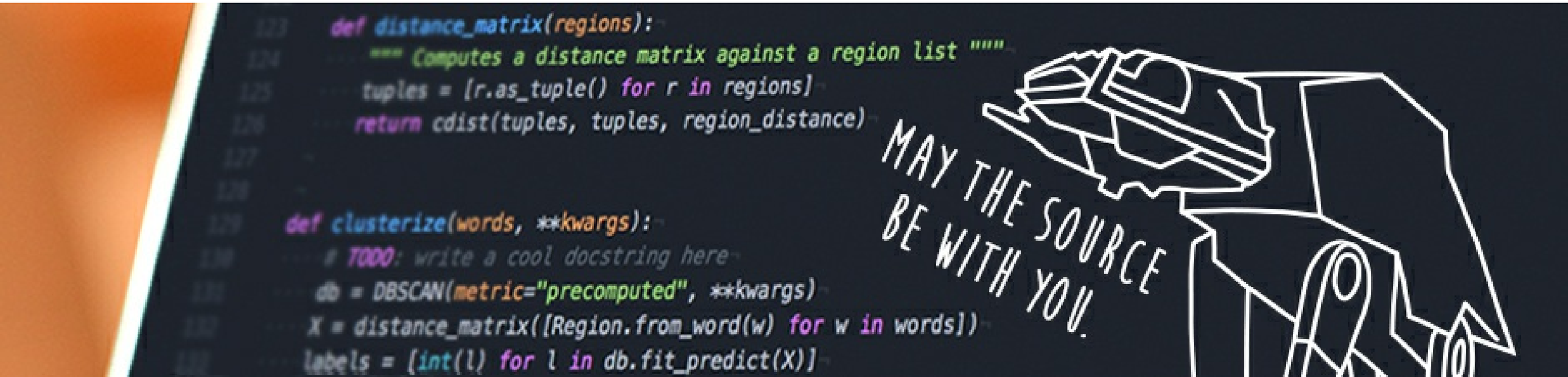
MAY THE SOURCE
BE WITH YOU.

# BACKUP SLIDES



# EVERYTHING RUNS IN POD

Kubernetes administrated with kubernetes:

- everything run in pods
- e.g., you deploy your log collectors for k8s as pods: http://wbarczynski.pl/centralized-logging-for-kubernetes-with-fluentd-and-elasticsearch/

# BASIC CONCEPTS

- config / secret ➡ config and files
- ingress-controller ➡ url pattern ➡ service

# CONFIG

- env variables in deployment:

```
env:
- name: SEARCH_ENGINE_USER
  value: mighty_mouse
```

# CONFIG

- feed envs from configmaps:

```
env:
- name: SEARCH_ENGINE_USER
  valueFrom:
      configMapKeyRef:
          name: my-config
          key: search.user
```

# CONFIG

- you can ship files using configmaps/secrets

```
kubectl create configmap my-config-file
    --from-file=config.json
```

# CONFIG

You can also run your own:

- HashiCorp Consul or etcd
- HashiCorp Vault

# THERE IS SO MUCH MORE

- resource quotas
- events in Kubernetes
- readiness probes
- liveness probes
- volumes
- stateful
- namespaces
- ...

# KUBERENTES

- Awesome command-line
- Resilient platform
- simple YAML files to setup your service,
- service discovery included
- annotations and metadata discovery included

# 0.1 ➡ 1.0

Your component needs to get much more smarter.

# SERVICE SELF-CONSCIOUSNESS

Your endpoint:

- *metrics/*
- *alertrules/*- [WIP]
- *health/* or *healthz/*
- *info/*

# DEEP LOOK INSIDE

- when I am ready to serve requests
- when I need to restart myself
- what to do when dependent services are down
- ...

# DEEP LOOK INSIDE

- Am I really stateless?
- Caching?
- fail-fast, start fast

# RELATIONS WITH OTHERS

- master-worker relationships
- waiting for other resources / services

# 12FACTOR APPS

- find services by name or URI
- move the important config to environment variables

# LOGGING

- logstash json format
- make configurable with ENV variable

**EFK** or ELK

# WHAT WITH YOUR DATABASES

- Keep it in a separated (k8s) cluster
- The best, go with DaaS
- With *Stateful*, you can run your db in k8s

Long discussion...

# MIGRATION OF ENV

Staging, production, canary, green/blue ...:

- If you have $$$, have a separated k8s cluster
- If not, use Namespaces

# APPS IN NEW WORLD

- 12 factor apps (Heroku, 2012)
- much much smarter
- much faster
- much more predictable
- much harder to develop :D
- Forging experience into code [WIP]: https://github.com/microdevs