Microservices in the Cloud using Kubernetes, Docker and Jenkins

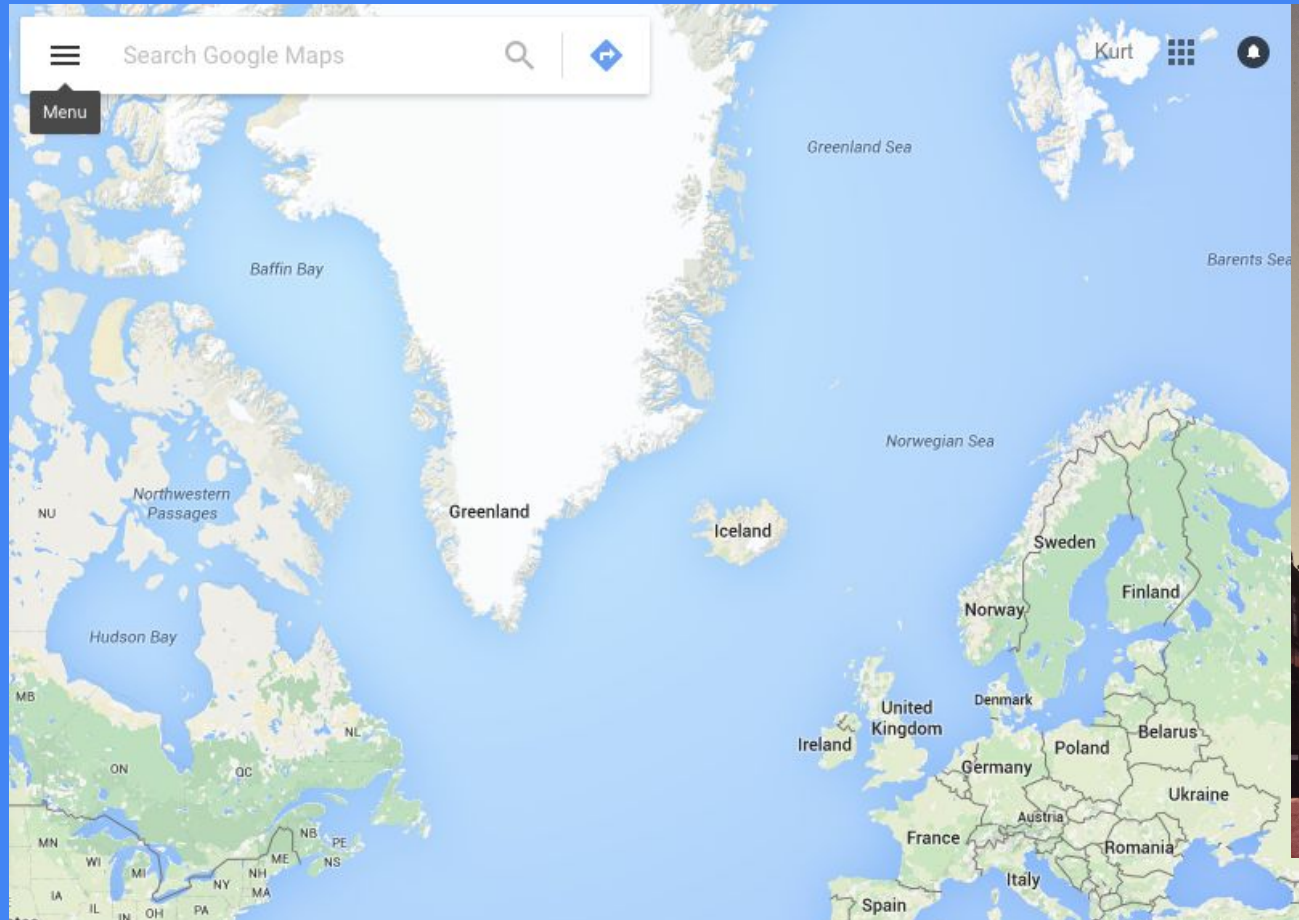
SATURN May 3rd, 2017

@KurtStam, PhD,
Principal Engineer on the #Fabric8/Fuse team

Content

- MicroAdventures & MicroServices
- Introduction to Docker
- Introduction to Kubernetes/OpenShift
- Demo of RPi Cluster running K8s
- Jenkins: Fabric8 CI/CD Pipeline

Spitsbergen Exp 1985




SPITSBERGEN '85

redhat.

redhat.

#microadventures

#microadventures

#microadventures

Monolith and Conventional Deployment

Lots of planning
Different teams and responsibilities
Regression Issues
Cheap to start, hard to maintain when you hit a certain complexity level

Micro Services

- Micro Services are about time to market
- Component reuse, not code reuse.
- ‘One concern’: Simple and small, but not too small
- Easy to test, limited risk of regressions, CI/CD
- One team from development to deployment
- API Contract (REST & Swagger), API Manager
- Perfect for cloud deployment!

Java Micro Services

- AngularJS UI for display logic
- REST Service(s) Swagger 2 for business backend
- SQL/No-SQL store & Caching

Open Source Cloud: Virtualization of the entire stack

- Fabric8: iPaas
- OpenShift: Paas
- Kubernetes: Docker Orchestration
- Docker OS Level Virtualization

Open Source Cloud: Virtualization of the entire stack

Shipping Containers At Clyde, by Steve Gibson

docker

Shipping software is hard

Multiplicity of Stacks

Static website

nginx 1.5 + modsecurity + openssl + bootstrap 2

User DB

postgresql + pgv8 + v8

Queue

Redis + redis-sentinel

Analytics DB

hadoop + hive + thrift + OpenJDK

Background workers

Python 3.0 + celery + pyredis + libcurl + ffmpeg + libopencv + nodejs + phantomjs

Web frontend

Ruby + Rails + sass + Unicorn

API endpoint

Python 2.7 + Flask + pyredis + celery + psycopg + postgresql-client

Do services and apps interact appropriately?

Multiplicity of hardware environments

Development VM

QA server

Customer Data Center

Public Cloud

Disaster recovery

Production Cluster

Production Servers

Contributor's laptop

Can I migrate smoothly and quickly?

Matrix from Hell

	Development VM	QA Server	Single Prod Server	Onsite Cluster	Public Cloud	Contributor's laptop	Customer Servers
Static website	?	?	?	?	?	?	?
Web frontend	?	?	?	?	?	?	?
Background workers	?	?	?	?	?	?	?
User DB	?	?	?	?	?	?	?
Analytics DB	?	?	?	?	?	?	?
Queue	?	?	?	?	?	?	?

Analogy with Cargo Transport Pre-1960

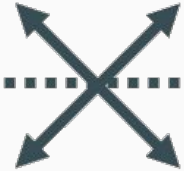
Multiplicity of Goods







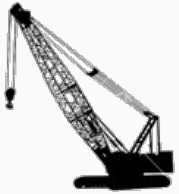
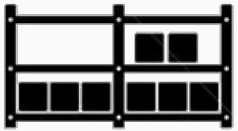
Do I worry about how goods interact (e.g. coffee beans next to spices)



Multipilicity of methods for transporting/storing





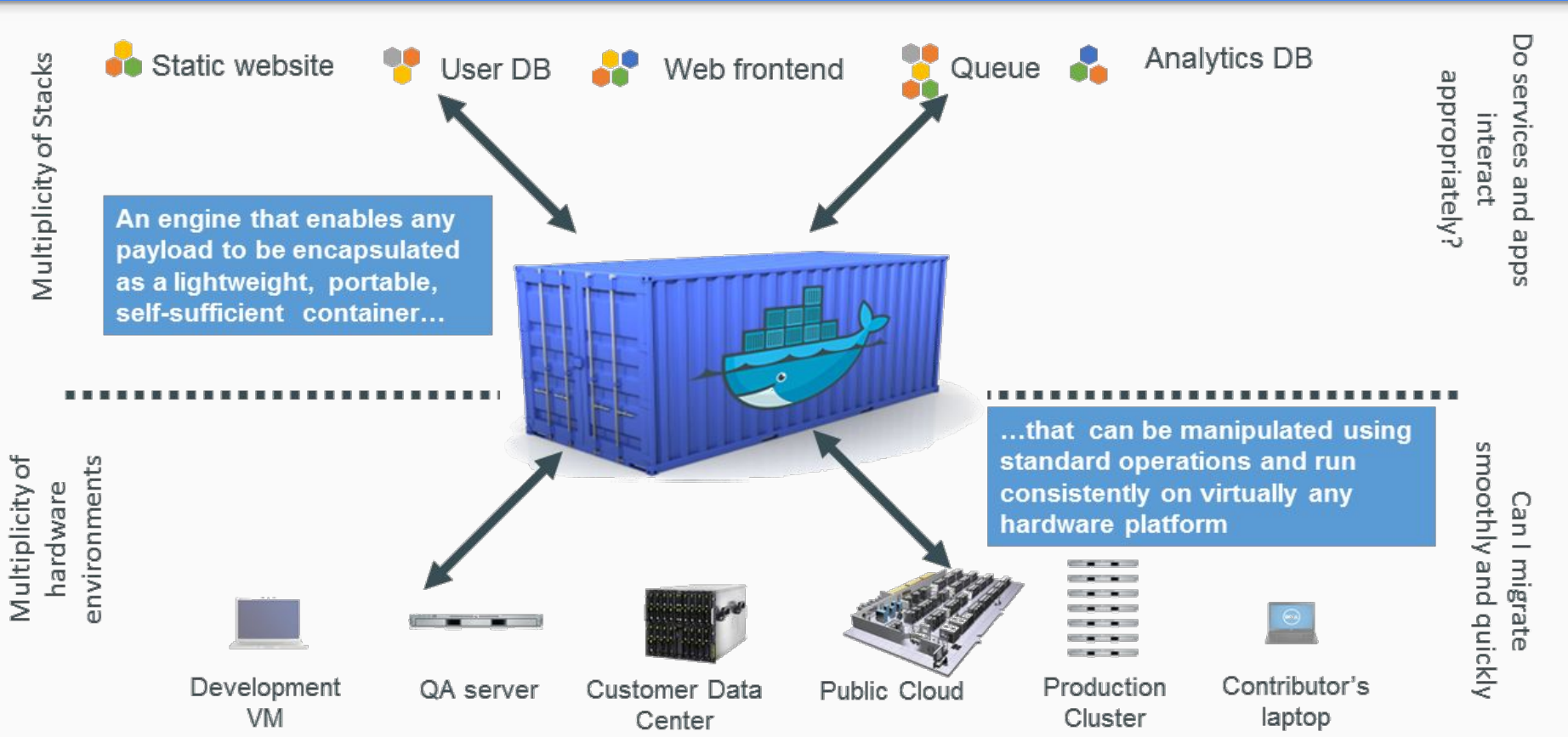

Can I transport quickly and smoothly (e.g. from boat to train to truck)

Same Matrix from Hell

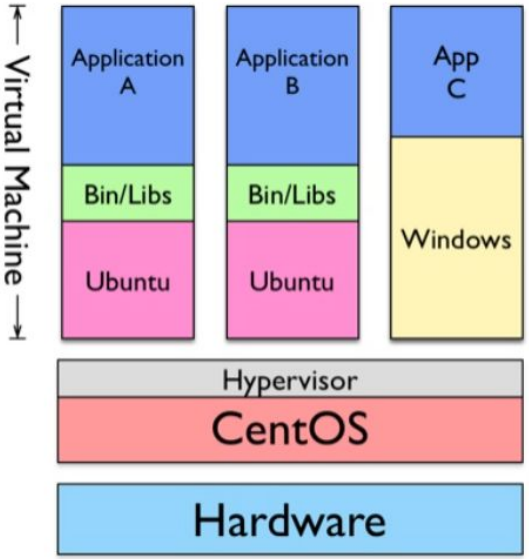
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
	?	?	?	?	?	?	?
							

Solution: Intermodal Shipping Container

Docker is the Shipping Container for Code

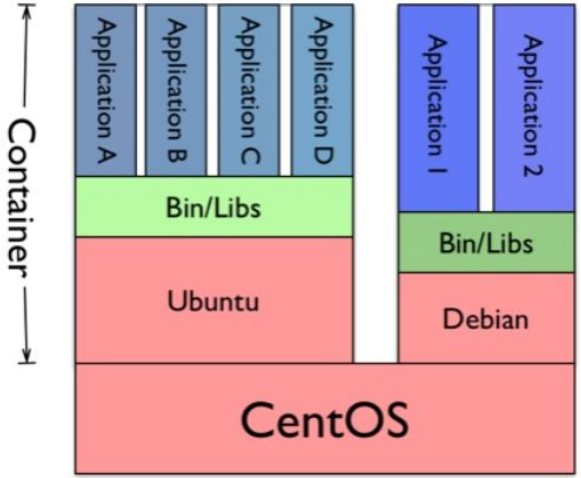


Lightweight Container vs. VM



Containers are isolated, but sharing the kernel and (some) files

➜ faster & lighter



Docker Demo: Hello World

Base Image + Shared Kernel
Process Isolation
Layers: pull, commit, push
DockerHub

```
Centos: yum install docker

docker run centos echo hello world

docker run -it centos bash

https://hub.docker.com/r/kurtstam/saturn
```

Docker Demo: Dockerfile


```
FROM php:5.6-apache                    (https://hub.docker.com/_/php/)
COPY src/ /var/www/html/
```

```
docker build -t php-hello-world .
```

```
docker run -it -p 80:8001 php-hello-world
```

Computational Resources: Cloud

Kubernetes

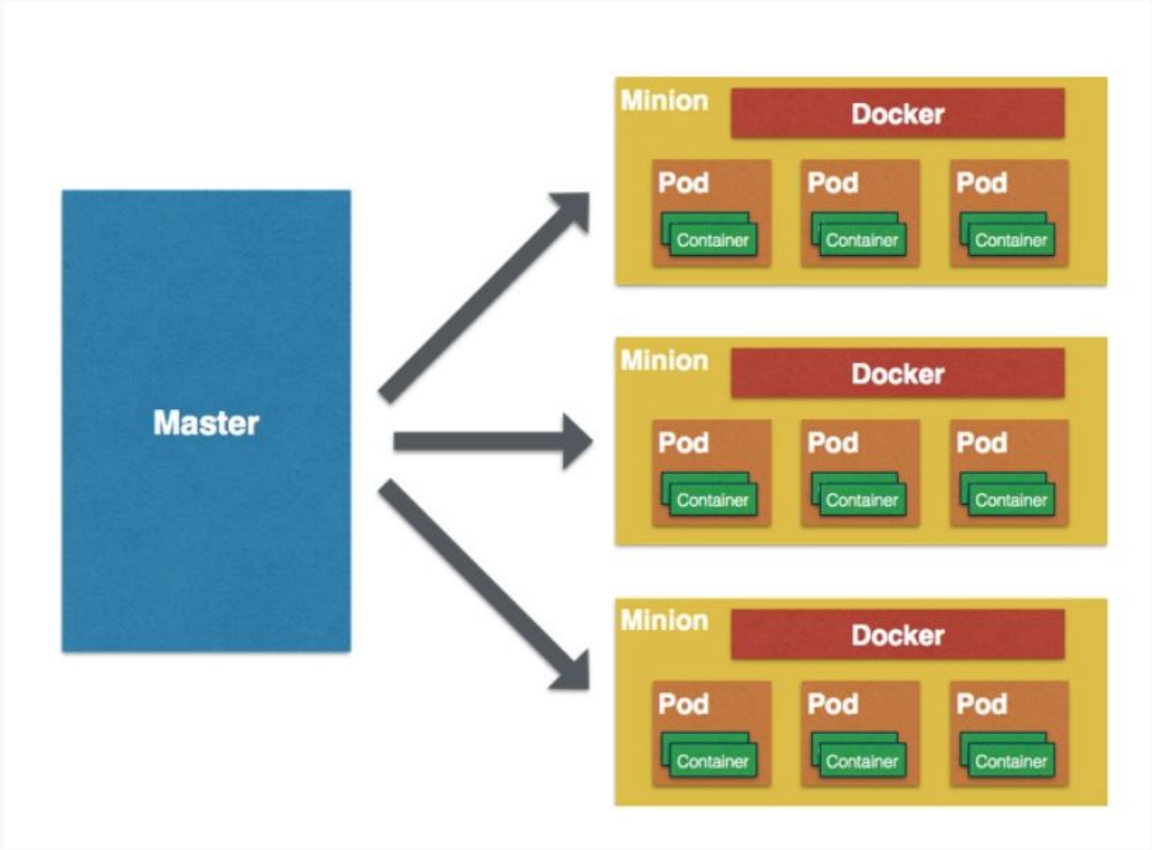
Kubernetes: ‘Helmsman of a ship’
based on Borg experiences

Container (Docker, Rocket) Orchestration
Cloud Operating System

Three flavors:

- OpenShift OnLine (Public PaaS) running on Amazon, Google, etc clouds
- OpenShift Enterprise (Private Paas), running in your data center
- Origin (Community Paas), running on a laptop (MiniKube, MiniShift)

Kubernetes


Master
Minion
Docker
Pod
Container
Pod
Container
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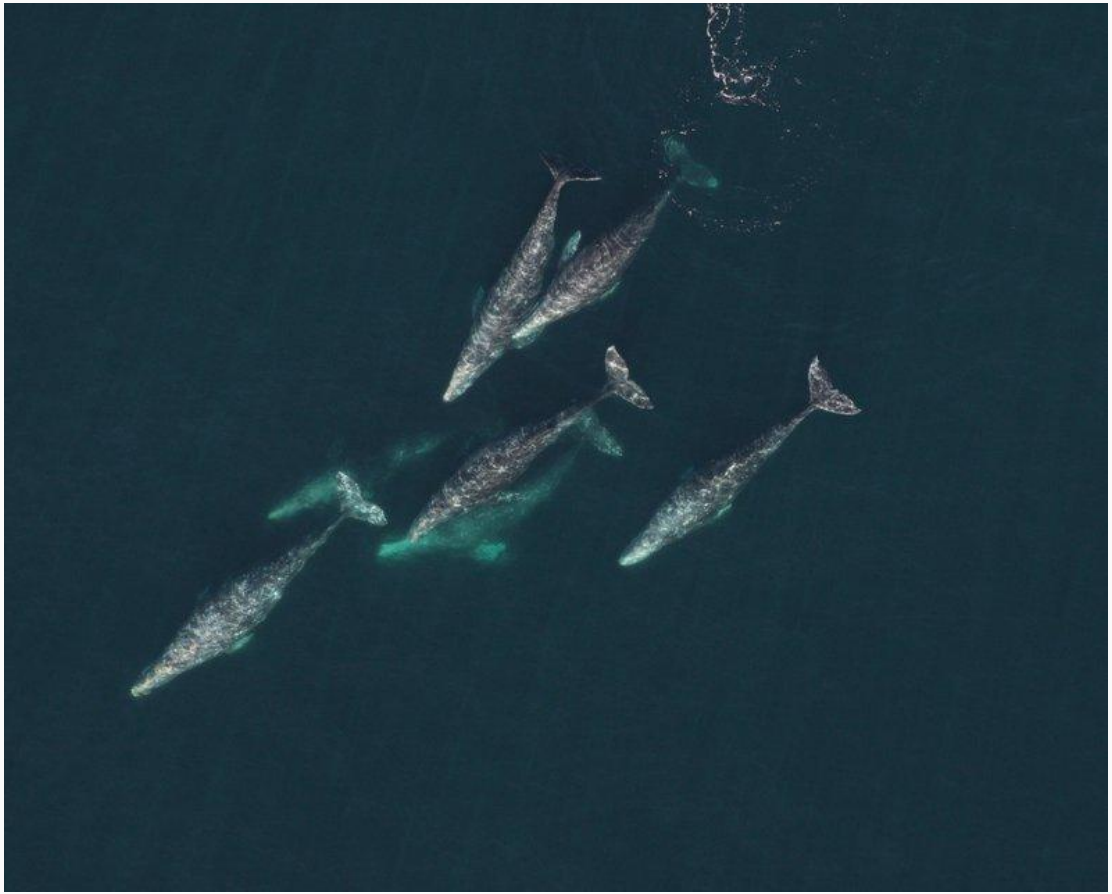
Container

Kubernetes Pod



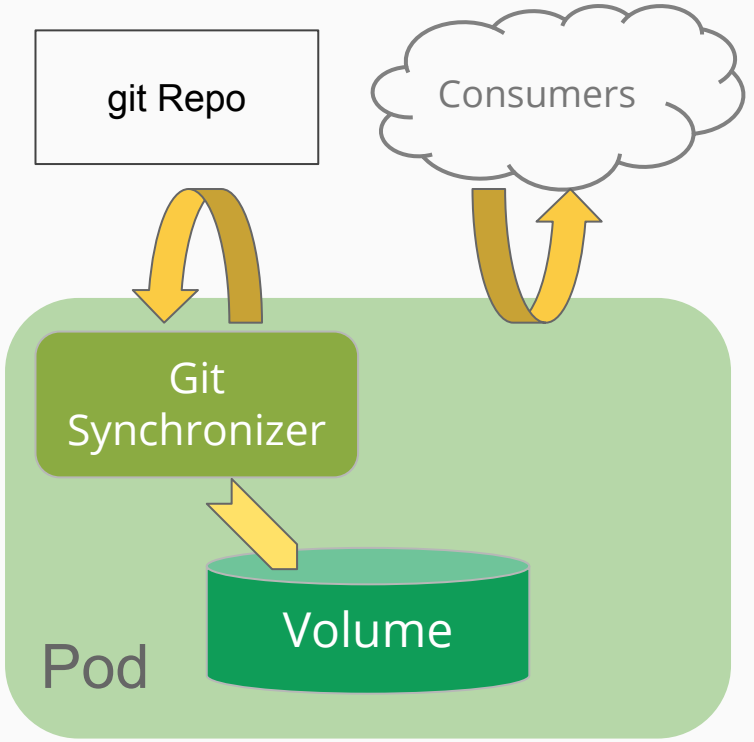
Kubernetes Pod

A Pod contains one or more containers

Containers within a pod are **tightly** coupled

Shared namespaces

- Containers in a pod share IP, port and IPC namespaces
- Containers in a pod talk to each other through localhost



Kubernetes Pod Networking

Pods have IPs which are routable

Pods can reach each other without NAT

- Even across nodes

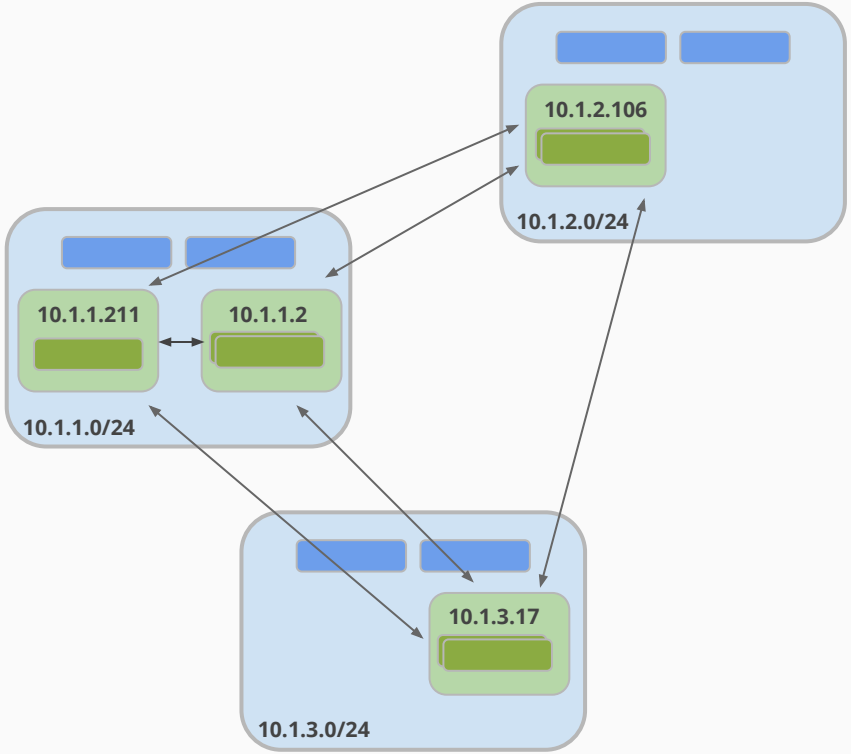
No Brokering of **Port Numbers**

These are fundamental requirements

Many solutions

- Flannel, Weave, OpenVSwitch, Cloud Provider

Let's deploy a pod!



Kubernetes Service

A logical grouping of pods that perform the same function

- grouped by label selector

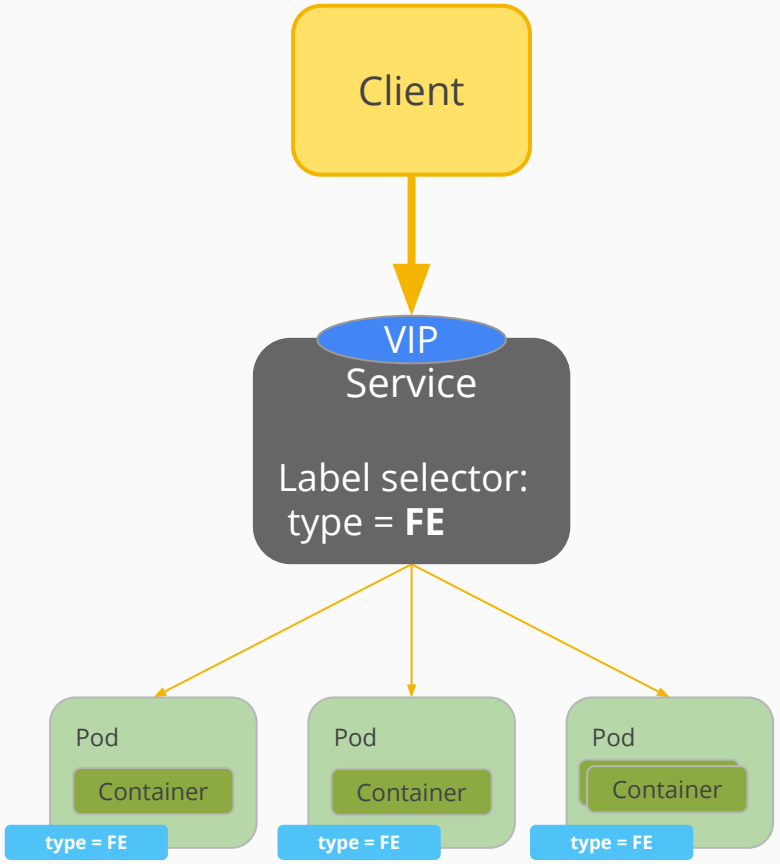
Load balances incoming requests across constituent pods

Choice of pod is random but supports session affinity (ClientIP)

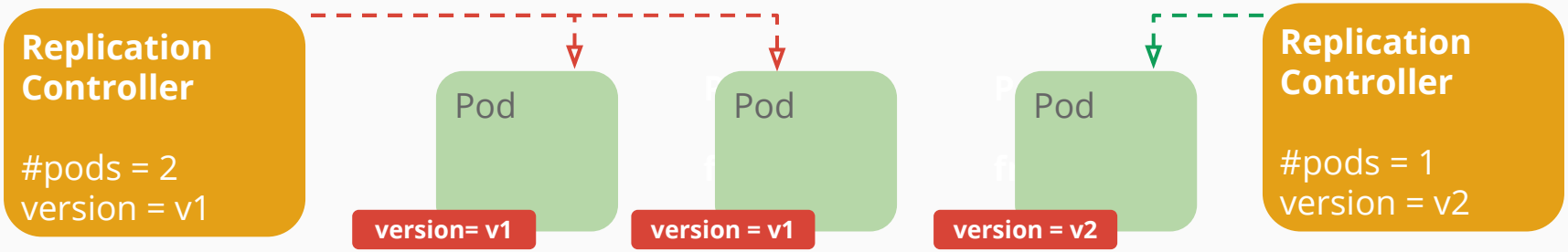
Gets a **stable** virtual IP and port

- also a DNS name

Let's deploy a service!



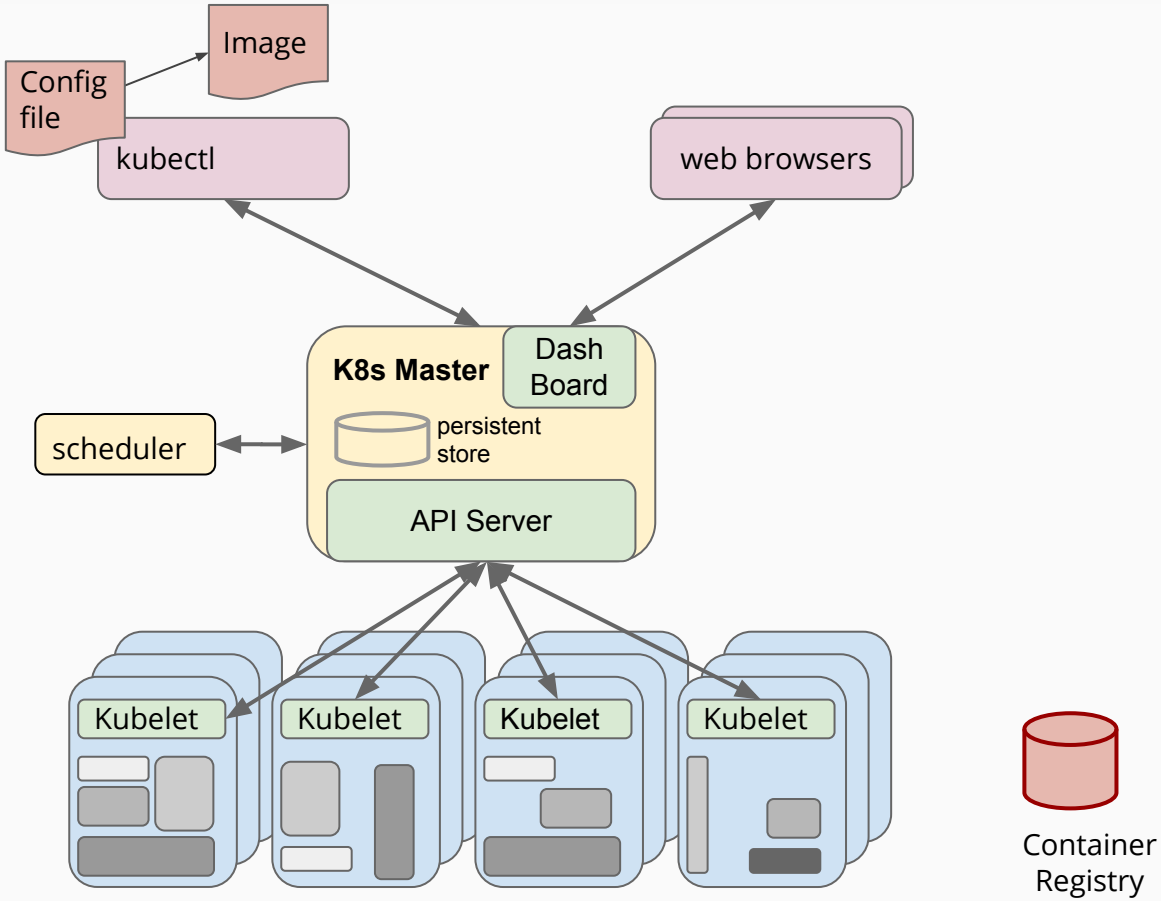
Kubernetes ReplicationController



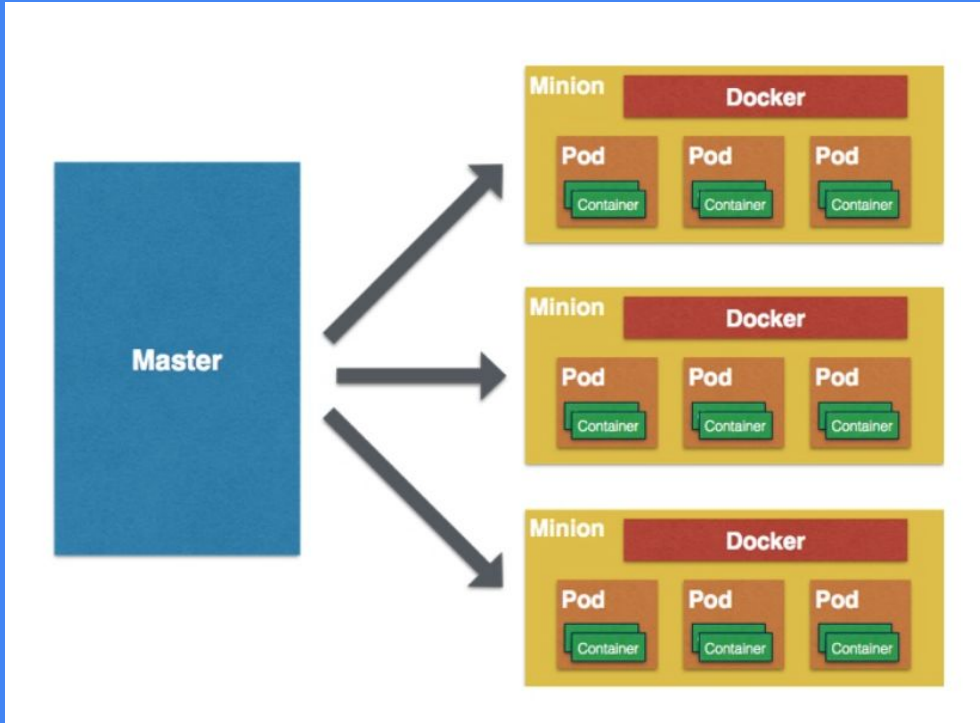
- Keeps Pods running
- Gives direct control of Pod #s
- Grouped by Label Selector

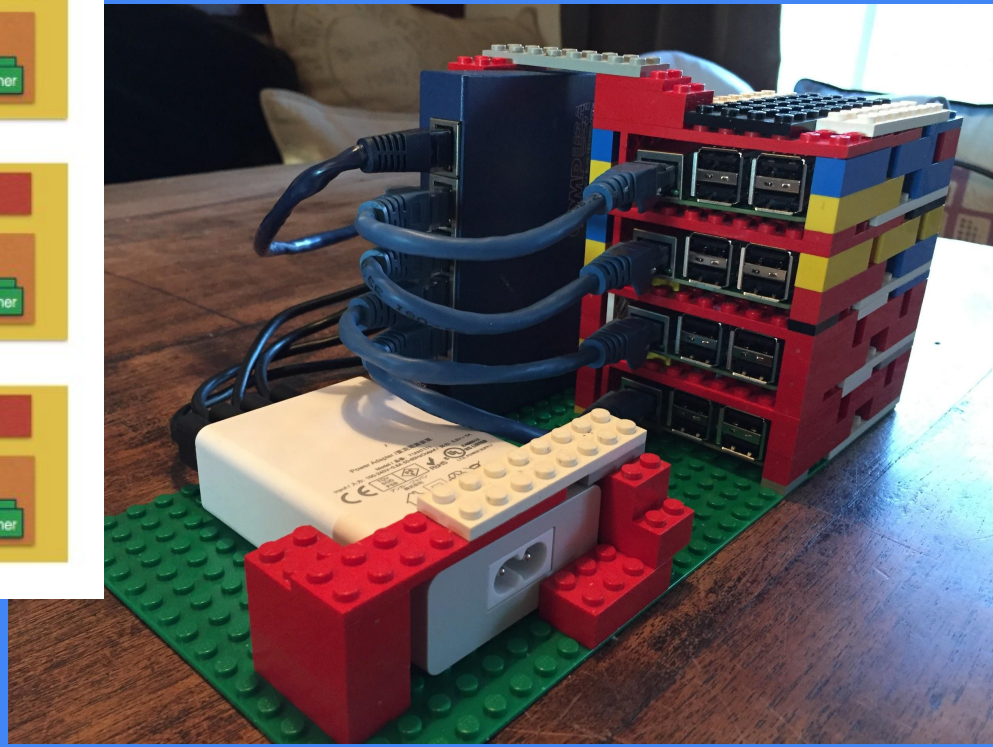
Let’s scale a service!

Developer View



Kubernetes on RaspberryPi





http://www.github.com/Project31

Shopping List

To build this four-Pi setup I used:

- 4 Raspberry Pi 2s
- 4 16GB MicroSD cards (Class 10)
- 1 60W power supply with USB outlets
- 4 short USB to Micro USB cables (for powering the Pis)
- 4 short Cat 5 network cables
- 1 longer Cat 5 network cable to hook into your network
- 1 network hub (Mine is an old five-port, 10/100MBps I dusted off)
- LEGOs (Trust me, it feels good to build your own!)

Fabric8

Fabric8 Management:

Hawtio Console, Logging, Metrics, Maven plugin

---------- containers ----------

Fabric8 iPaas:

ActiveMQ Messaging, Camel, **API management**

iPaaS Quickstarts:

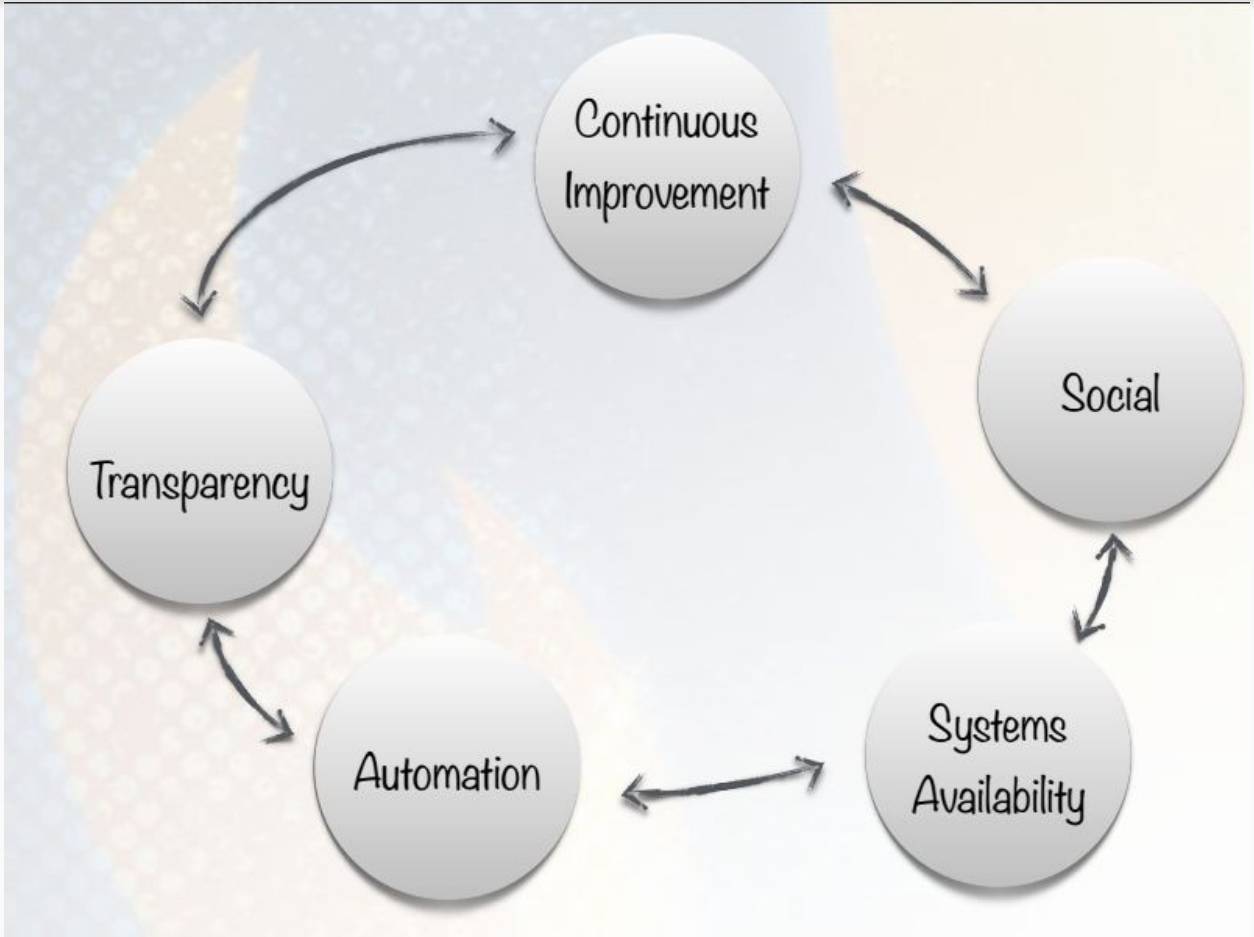
micro service examples

Fabric8 DevOps:

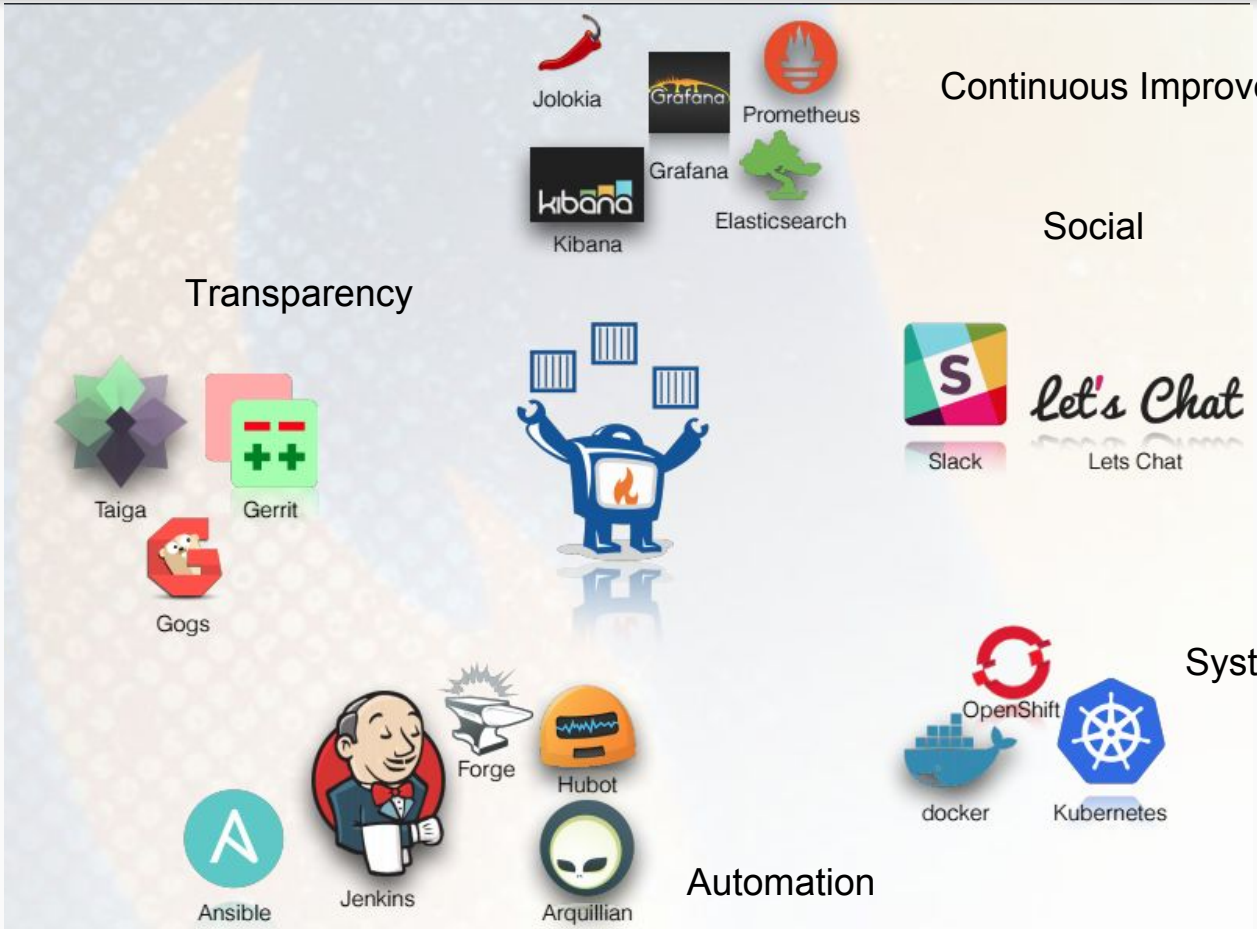
CD pipeline, jenkins, gogs, chat, gerrit, hubot

(q)

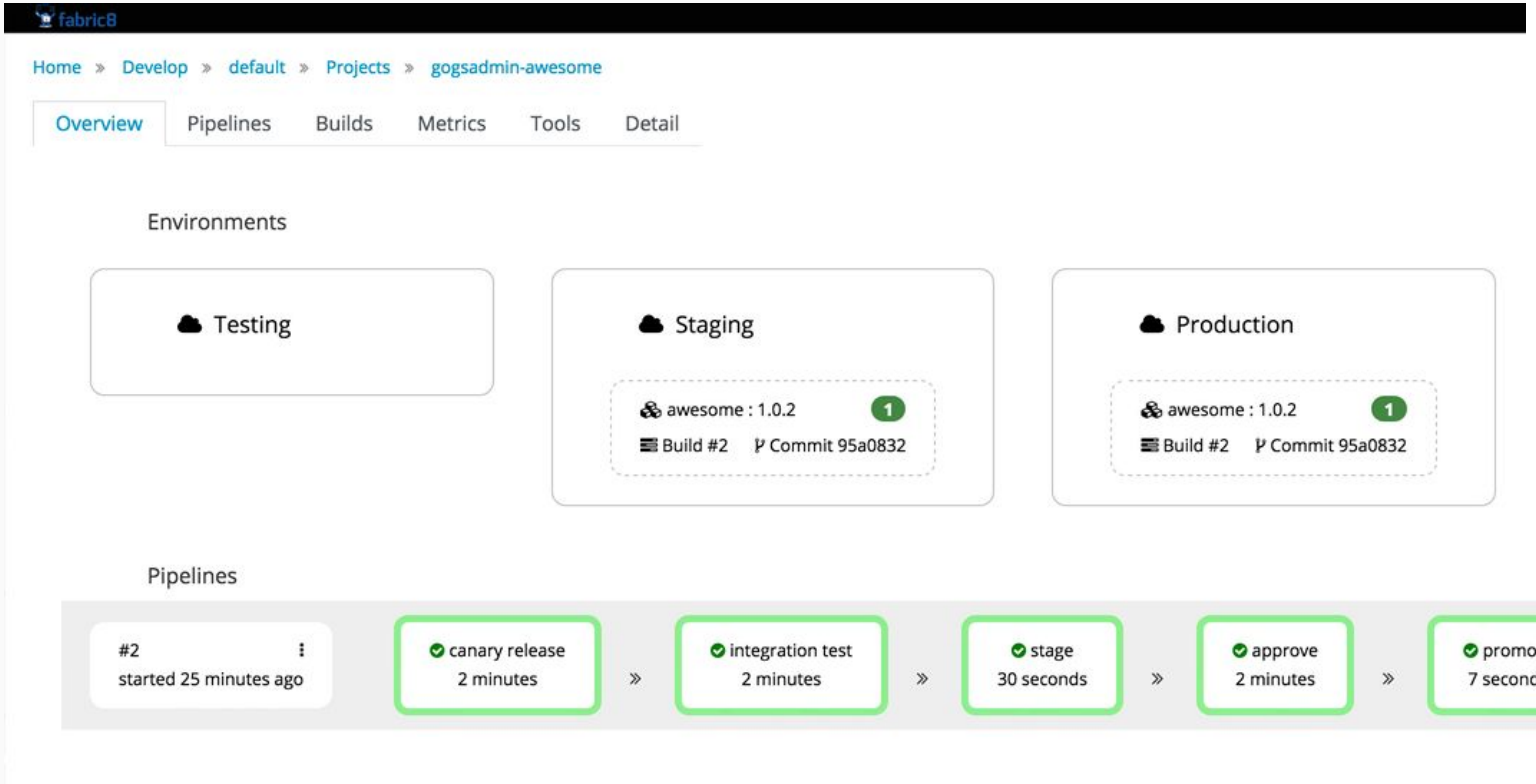
Developer Experience



Developer Systems



Continuous Delivery Pipeline using Fabric8 and Jenkins Demo



Questions?

Fabric8.io	Fabric8 Microservices Platform
Get Started	Create a Kubernetes Cluster with Fabric8
Docker.com	Create and Run Container Images
Kubernetes.io	Container based Cloud
Openshift.org	Red Hat product based on Kubernetes

@KurtStam

References

[1] http://www.fabric8.io

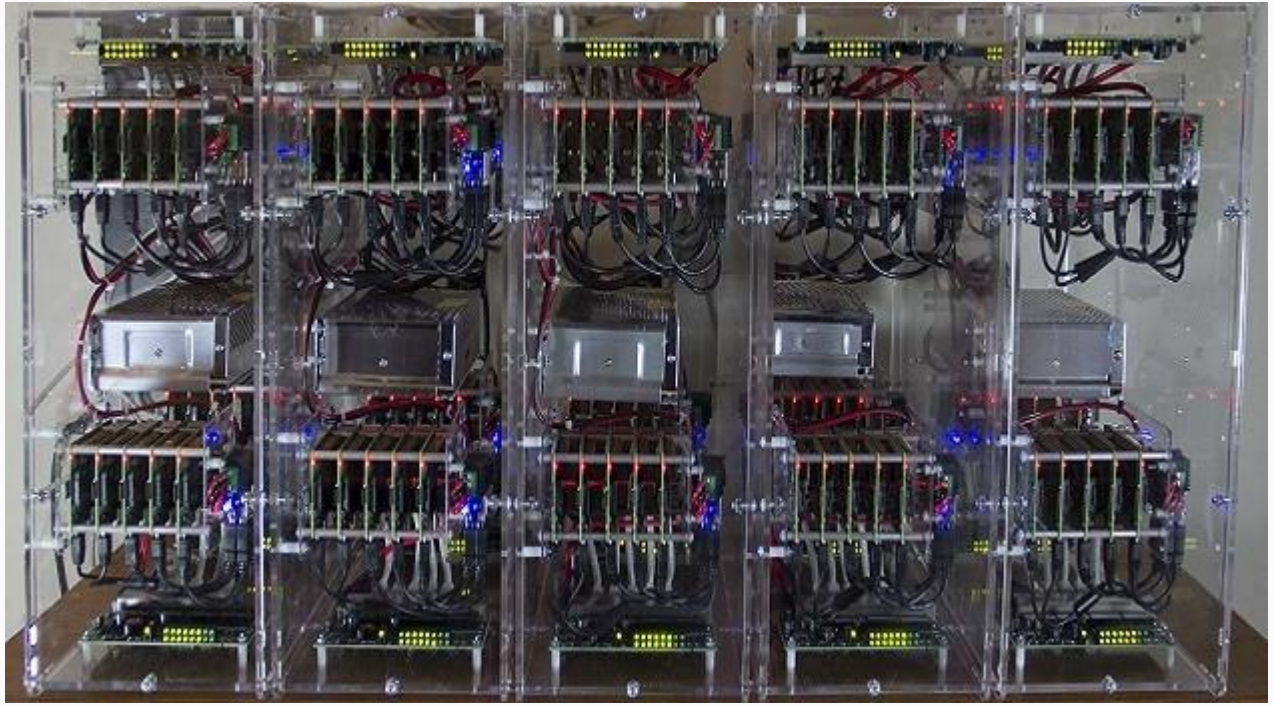
[2] http://www.apiman.io

[3] @tekggrl "Kubernetes: From Beginner to Expert"

[4] http://www.github.com/Project31

[5] https://opensource.com/life/16/2/build-a-kubernetes-cloud-with-raspberry-pi

Pico Cluster



100 RPi boards:

400 Cores
400 GB Ram

Storage on clustered MicroSD or SAN

8,000 $

Disruptive technology: Platform of tomorrow

Open Source Everything
Low cost
Low power
Redundant
Distributed
Super scalable