Spring Boot Apps on Kubernetes

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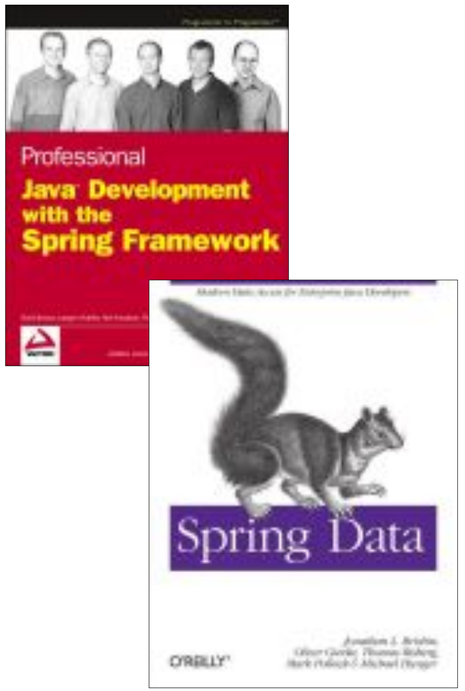
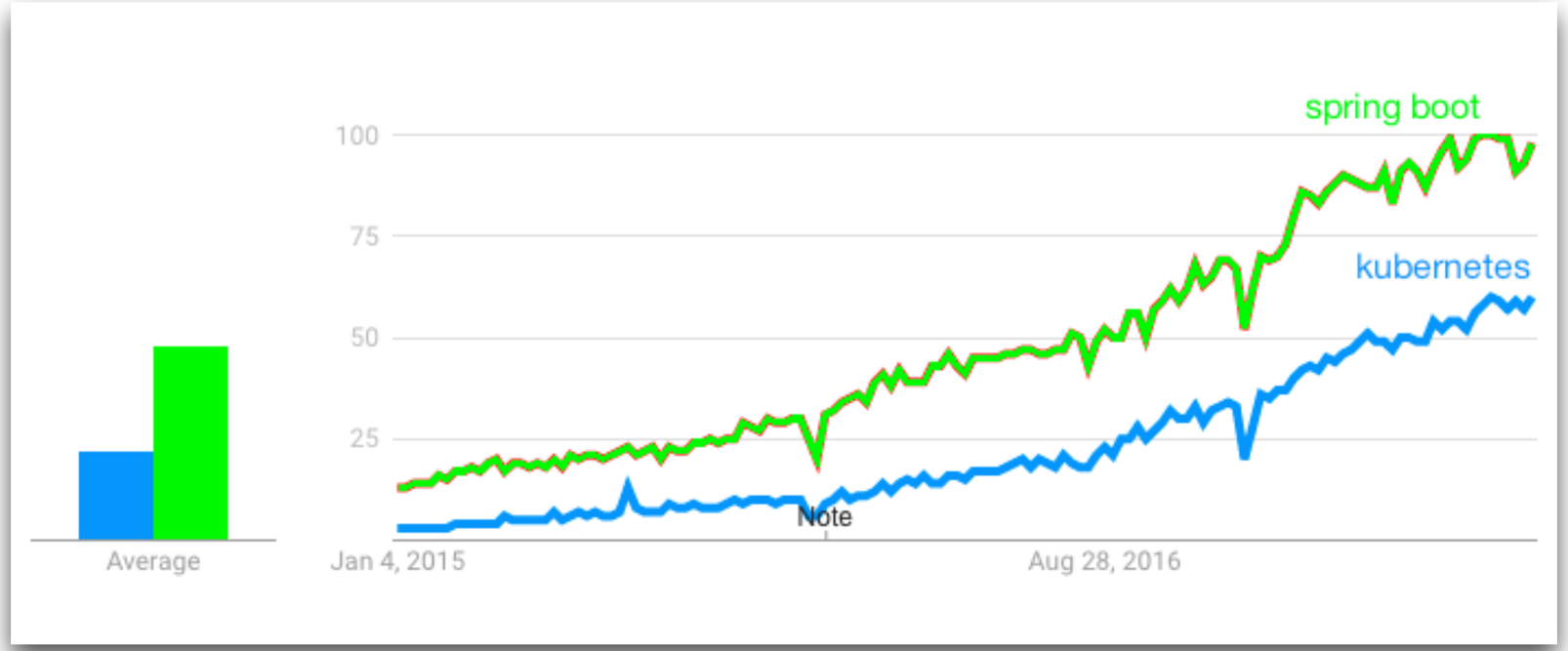
About me

Thomas Risberg (@trisberg)

- Member of the Spring engineering team at Pivotal
- Contributing to *Spring Cloud Data Flow, Spring Cloud Deployer for Kubernetes* projects
- Joined the Spring Framework open source project in 2003 working on JDBC support
- co-author of “Professional Java Development with Spring Framework” from Wrox 2005 and “Spring Data” book from O'Reilly 2012



Two Hot Technologies



Based on: https://trends.google.com/trends/explore?q=kubernetes,spring%20boot

Press/Analysts

RedMonk
the developer-focus

Videos Research Event

CHARTING STACKS

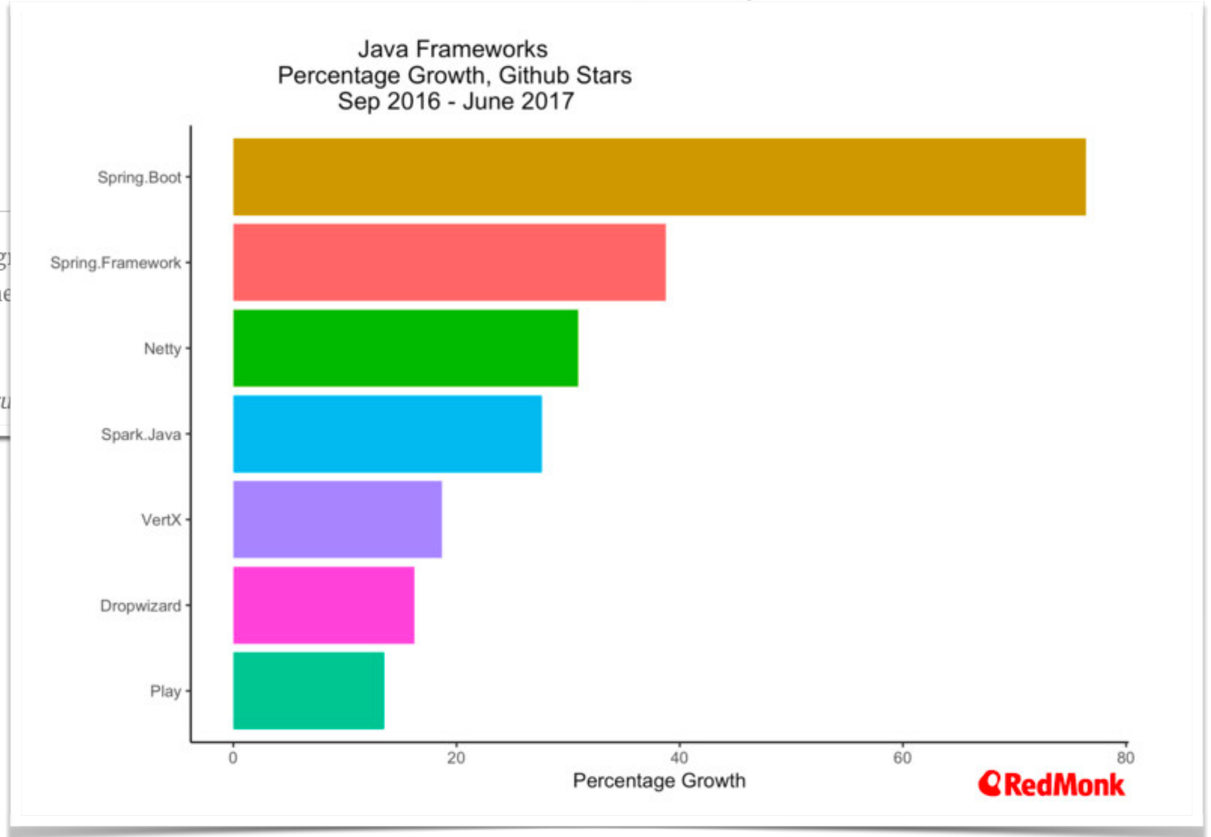
Language Framework Popularity: A Look at Java, June 2017

By fryan | June 22, 2017

TL; DR: Spring Boot is gr
most popular Java Frame
grow strongly

Framework: 'a basic stru

TL; DR: Spring Boot is growing at an exponential rate and is set to become the most popular Java Framework soon. Spring Framework and Netty continue to grow strongly



techcrunch.com

Kubernetes gains momentum as big-name vendors flock to Cloud Native Computing Foundation

Ron Miller

3-4 minutes

Like a train gaining speed as it leaves the station, the Cloud Native Computing Foundation is quickly gathering momentum, attracting some of the biggest names in tech. In the last month and a half alone AWS, Oracle, Microsoft, VMware and Pivotal have all joined.

What is Spring Boot?

Spring Boot takes an opinionated view of building production-ready Spring applications. Spring Boot favors convention over configuration and is designed to get you up and running as quickly as possible.

http://projects.spring.io/spring-boot/

Pair-programming with Spring Team

What is Kubernetes?

Kubernetes is an open-source system for automating deployment, scaling, and management of containerized applications.

It groups containers that make up an application into logical units for easy management and discovery.

https://kubernetes.io/

Pairing
with Google SRE Team?

Kubernetes builds upon 15 years of experience of running production workloads at Google, combined with best-of-breed ideas and practices from the community.

Running Kubernetes

- Development - Minikube
  - https://kubernetes.io/docs/getting-started-guides/minikube/#installation
- Hosted
  - Google Container Engine (GKE)
  - Azure Container Service
  - IBM Bluemix Container Service
- Custom Cluster

Running Apps on Minikube

- Build Docker image

```
eval $(minikube docker-env)
docker build -t trisberg/hello:0.0.1 .
```

- Using `kubectl` command line - run app

```
kubectl run hello --image trisberg/hello:0.0.1 --port=8080
```

- Expose the app port

```
kubectl expose deployment hello --type=NodePort
```

Demo

Simple Hello
Spring Boot/Kubernetes
app deployment

- https://github.com/trisberg/boot-k8s/blob/master/demo-hello.adoc

Spring Cloud / Netflix OSS

- Spring Cloud Config
- Service Discovery
  - Netflix Eureka
  - Consul
- Load balancing / routing
  - Netflix Ribbon & Zuul
- Circuit Breakers
  - Netflix Hystrix

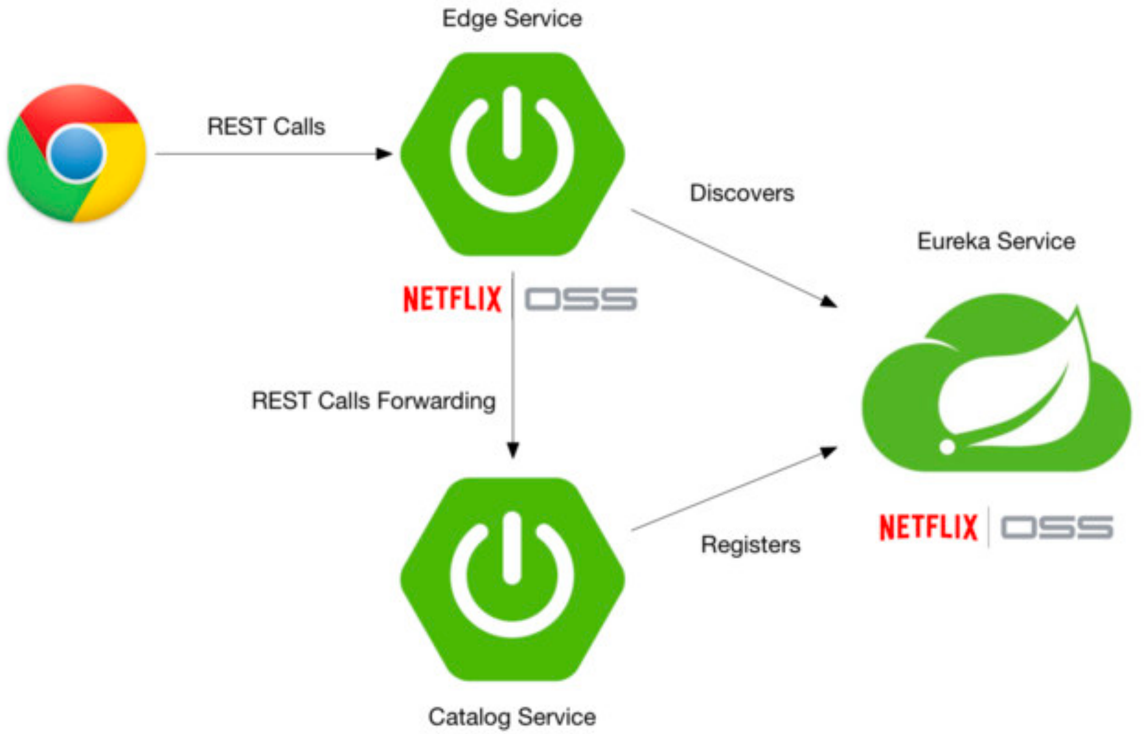


Image from: https://www.slideshare.net/mraible/develop-hip-apis-and-apps-with-spring-boot-and-angular-connecttech-2017/16?src=clipshare

https://projects.spring.io/spring-cloud/

Spring Cloud for Kubernetes

- Fabric8 team created some integration libs

  `spring-cloud-kubernetes`

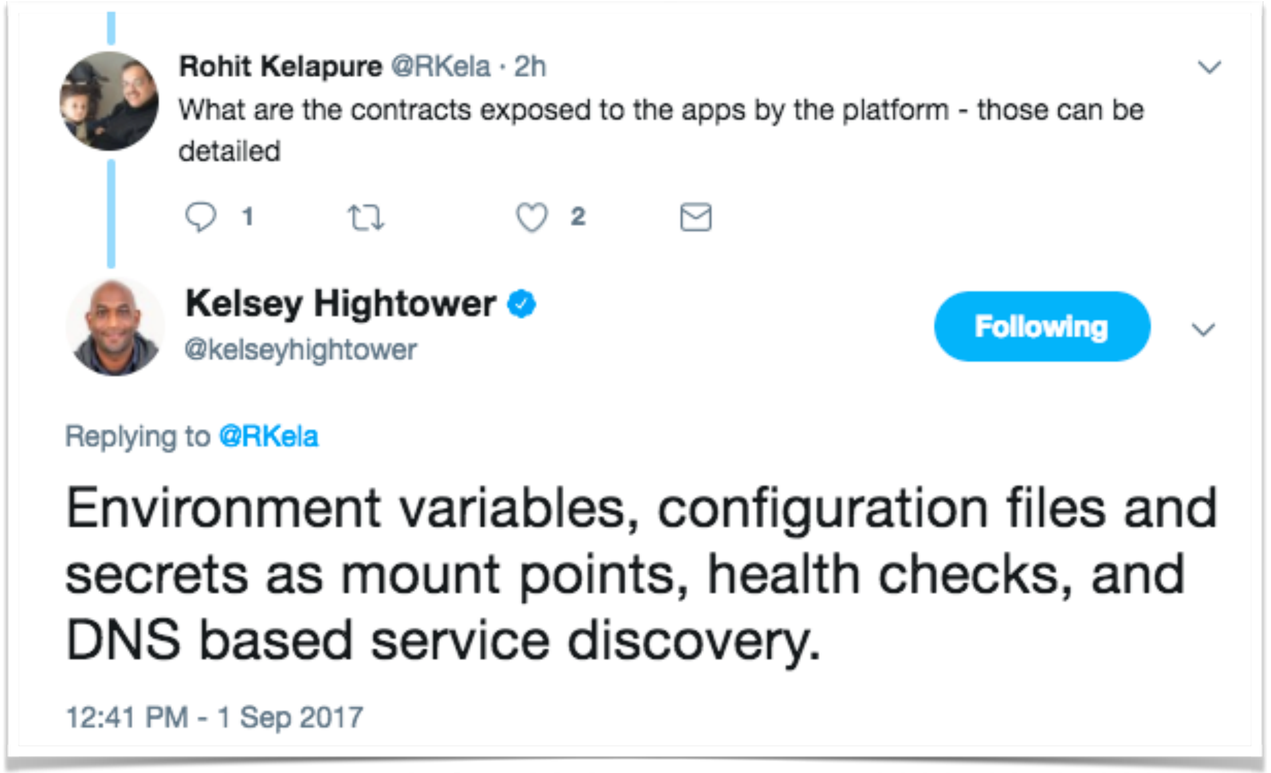
- Now available in `spring-cloud-incubator` on GitHub

Building Apps for Kubernetes

https://twitter.com/kelseyhightower/status/903640408613306369

Contracts exposed to the apps by the platform

- Environment variables
- Configuration files
- Secrets as mount points
- Health checks
- DNS based service discovery



https://twitter.com/kelseyhightower/status/903643916599046145

Demo

Simple REST Repository App

- https://github.com/trisberg/boot-k8s/blob/master/demo-actors.adoc

Configuration

```
<dependency>
   <groupId>org.springframework.cloud</groupId>
   <artifactId>spring-cloud-starter-kubernetes-config</artifactId>
   <version>0.2.0.RELEASE</version>
</dependency>
```

- Environment variables
- Configuration files
- Secrets

```
env:
- name: SPRING_PROFILES_ACTIVE
  value: kubernetes
- name: SPRING_CLOUD_KUBERNETES_CONFIG_NAME
  value: actors
- name: SPRING_CLOUD_KUBERNETES_SECRETS_ENABLE_API
  value: 'true'
- name: SPRING_CLOUD_KUBERNETES_SECRETS_NAME
  value: mysql
```

Health Checks

```
<dependency>
   <groupId>org.springframework.boot</groupId>
   <artifactId>spring-boot-starter-actuator</artifactId>
</dependency>
```

```
livenessProbe:
  httpGet:
    path: /health
    port: 80
  initialDelaySeconds: 90
  periodSeconds: 15
  timeoutSeconds: 5
readinessProbe:
  httpGet:
    path: /health
    port: 80
  initialDelaySeconds: 45
  periodSeconds: 15
  timeoutSeconds: 5
```

```
resources:
  limits:
    cpu: 1.0
    memory: 1024Mi
  requests:
    cpu: 0.5
    memory: 640Mi
```

Service Discovery

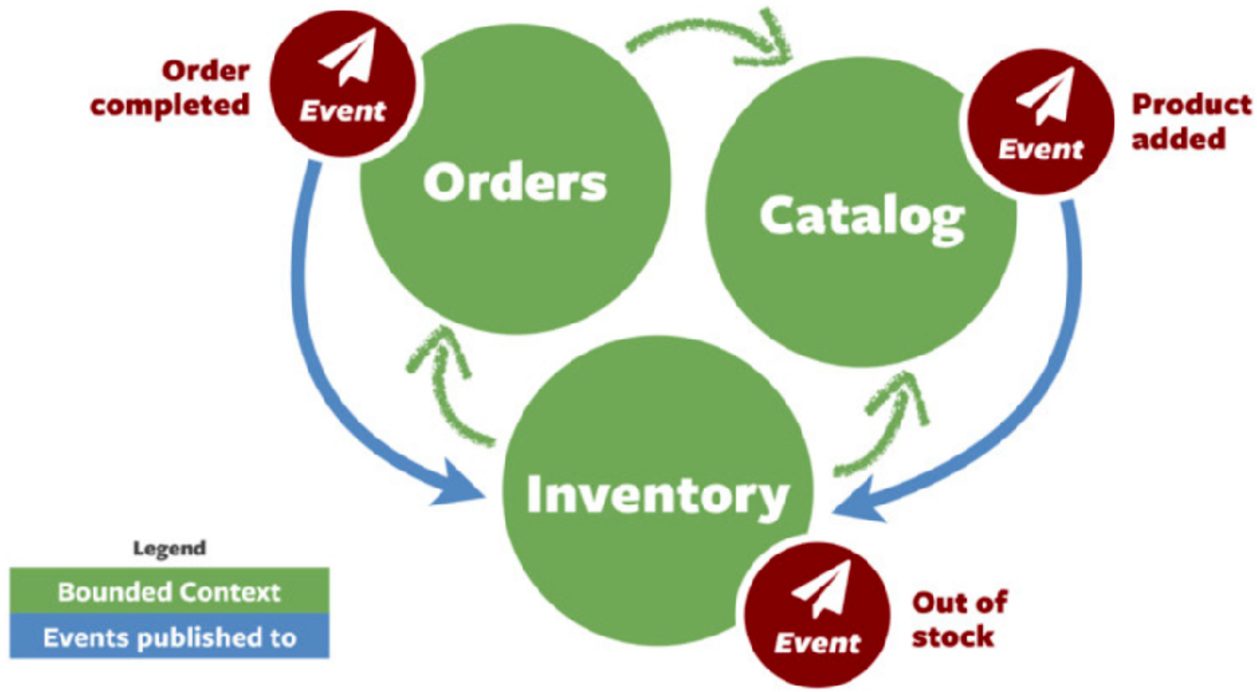
ConfigMap using env vars:

```
data:
  application.yaml: |-
    security:
      basic:
        enabled: false
    spring:
      datasource:
        url: jdbc:mysql://${MYSQL_SERVICE_HOST}:${MYSQL_SERVICE_PORT}/mysql
        username: root
        password: ${mysql-root-password}
        driverClassName: com.mysql.jdbc.Driver
        testOnBorrow: true
        validationQuery: "SELECT 1"
```

or DNS: `url: jdbc:mysql://mysql:3306/mysql`

Microservice Architecture Concerns

- Externalized Configuration
  - ConfigMap and Secrets ✔
- Service Discovery
  - DNS, DiscoveryClient ✔
- Circuit-breaker
- Distributed Tracing
- Metrics
- Log aggregation



https://speakerdeck.com/olivergierke/refactoring-to-a-system-of-systems?slide=29

Circuit-breaker
Netflix Hystrix

```
@HystrixCommand(commandKey = "ActorByName", fallbackMethod = "noActors", commandProperties = {
    @HystrixProperty(name = "execution.isolation.thread.timeoutInMilliseconds", value = "5000")
})
Collection<Resource<ActorResource>> getActorByName(@PathVariable String name) {

  ...

  return actors;
}

Collection<Resource<ActorResource>> noActors(@PathVariable String name) {

  ...

  return empty;
}
```

```
@SpringBootApplication
@EnableCircuitBreaker
public class GatewayApplication {

  public static void main(String[] args) {
    SpringApplication.run(GatewayApplication.class, args);
```

```
<dependency>
   <groupId>org.springframework.cloud</groupId>
   <artifactId>spring-cloud-starter-hystrix</artifactId>
</dependency>
```

Distributed Tracing
Zipkin

```
<dependency>
   <groupId>org.springframework.cloud</groupId>
   <artifactId>spring-cloud-starter-kubernetes-zipkin</artifactId>
   <version>0.2.0.RELEASE</version>
</dependency>
```

```
spring.sleuth.sampler.percentage=1.0
```

```
containers:
- name: zipkin
  image: docker.io/openzipkin/zipkin:latest
  imagePullPolicy: IfNotPresent
  ports:
  - containerPort: 9411
  env:
  - name: POD_NAMESPACE
    valueFrom:
      fieldRef:
        apiVersion: v1
        fieldPath: metadata.namespace
```

Metrics

- /metrics

```
<dependency>
   <groupId>org.springframework.boot</groupId>
   <artifactId>spring-boot-starter-actuator</artifactId>
</dependency>
```

- /prometheus

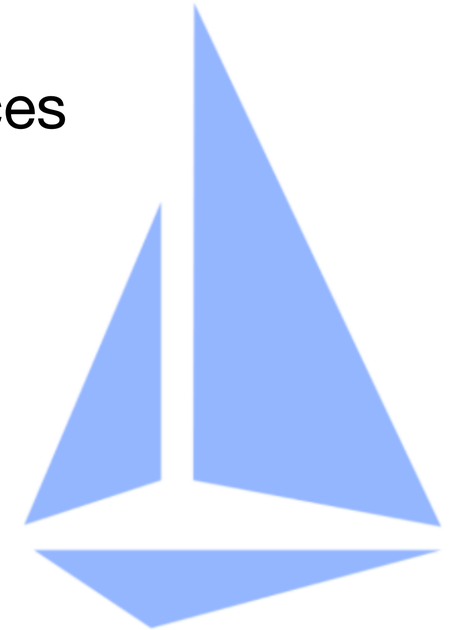
```
<dependency>
   <groupId>com.moelholm</groupId>
   <artifactId>prometheus-spring-boot-starter</artifactId>
   <version>1.0.2</version>
</dependency>
```

Log Aggregation

- Stackdriver
  - https://kubernetes.io/docs/tasks/debug-application-cluster/logging-stackdriver/
- Elasticsearch and Kibana
  - https://kubernetes.io/docs/tasks/debug-application-cluster/logging-elasticsearch-kibana/
- Loggly
  - https://www.weave.works/blog/log-aggregation-kubernetes-loggly/
- Spring Cloud Sleuth
  - https://cloud.spring.io/spring-cloud-sleuth/

Service Mesh

- **Istio**
  - An open platform to connect, manage, and secure microservices
    - Intelligent Routing and Load Balancing
    - Resilience Across Languages and Platforms
    - Fleet-Wide Policy Enforcement
    - In-Depth Telemetry and Reporting
  - https://istio.io/



Packaging

- **Helm**
  - The package manager for Kubernetes
  - https://docs.helm.sh/using_helm/#quickstart-guide

Demo

Helm chart for the Simple REST Repository App

- https://github.com/trisberg/boot-k8s/blob/master/demo-helm.adoc

Connection to GCP Services

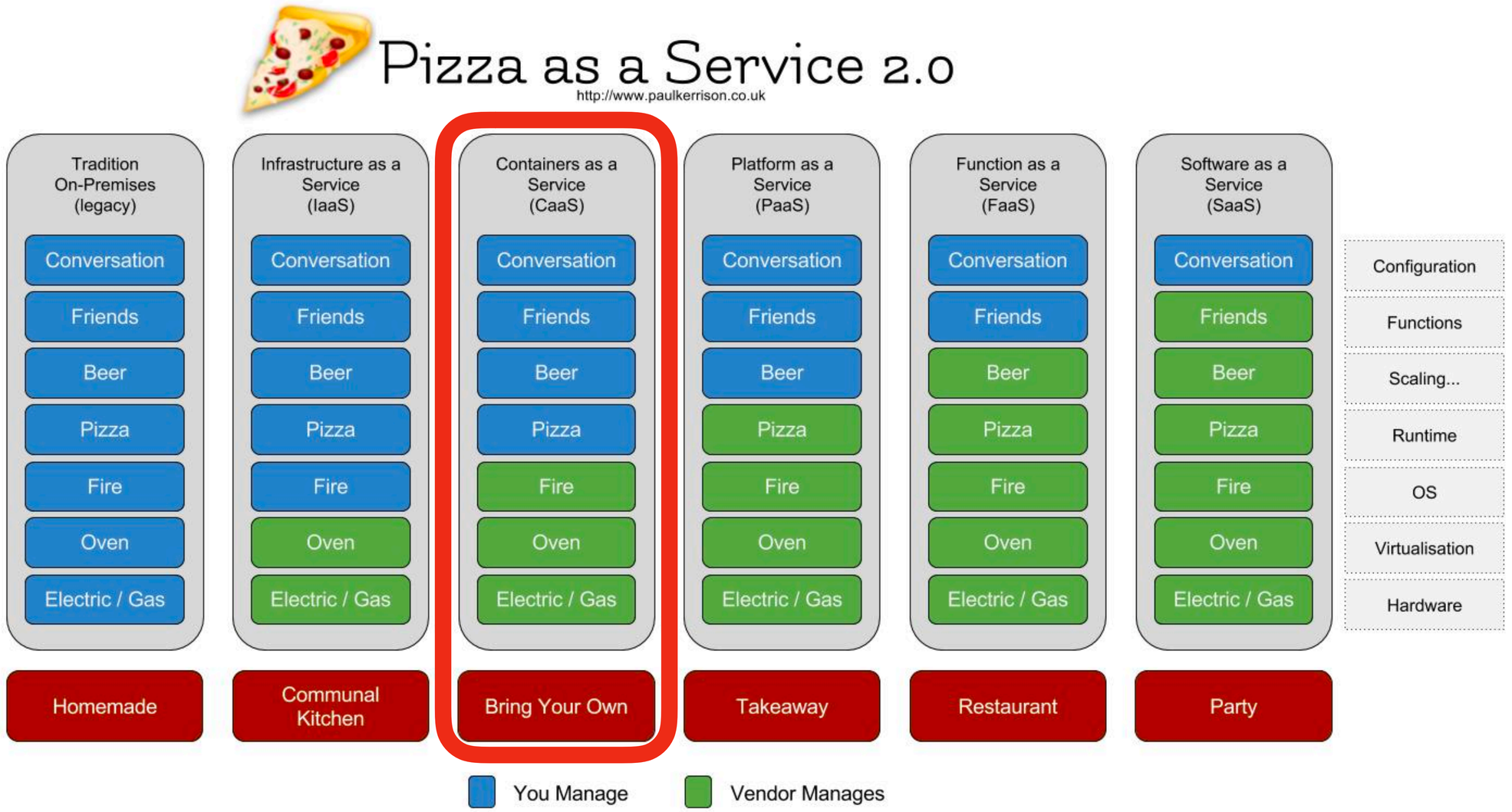
- Enable the Cloud SQL API
- Create a MySQL Database (2nd Generation)
- Create a Service Account
- Use a Side Car Proxy

Demo

Simple REST Repository App using Cloud SQL for MySQL

- https://github.com/trisberg/boot-k8s/blob/master/demo-cloud-sql.adoc

Pizza Maturity Model



https://www.linkedin.com/pulse/pizza-service-20-paul-kerrison