Developing
Java based microservices
ready for the world of containers


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Claus Ibsen

- Principal Software Engineer
  at Red Hat

- Apache Camel
  8 years working with Camel

- Author of
  Camel in Action books


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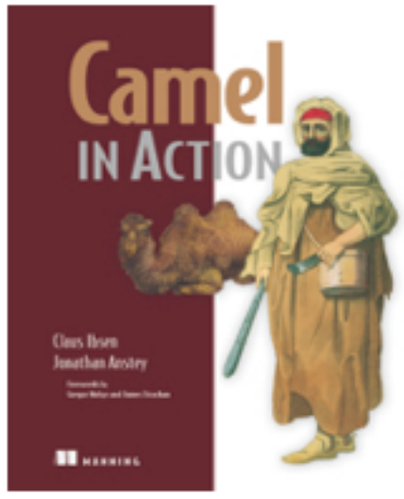
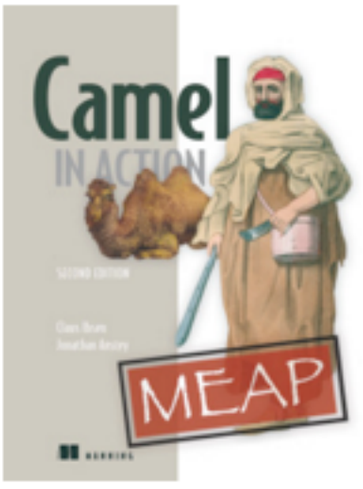
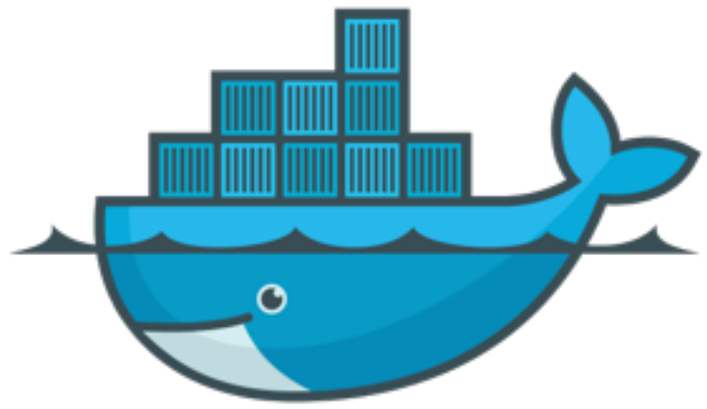


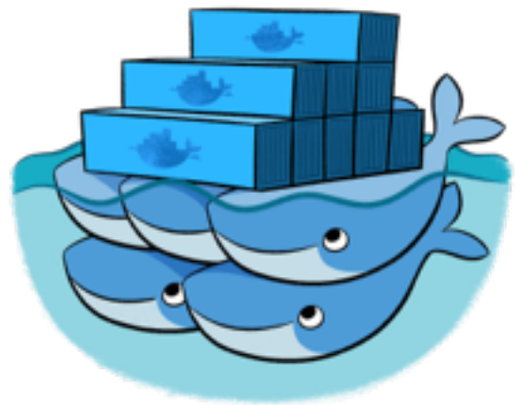


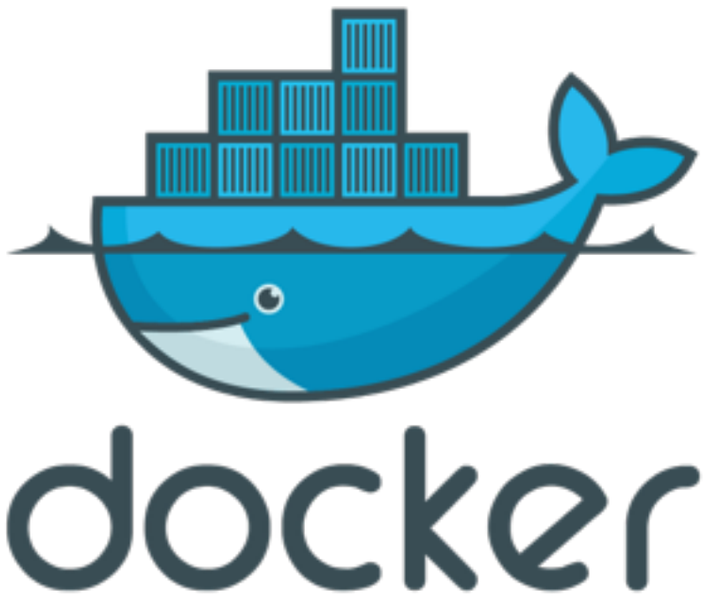


docker

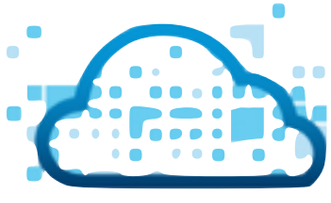
MESOS

DEIS

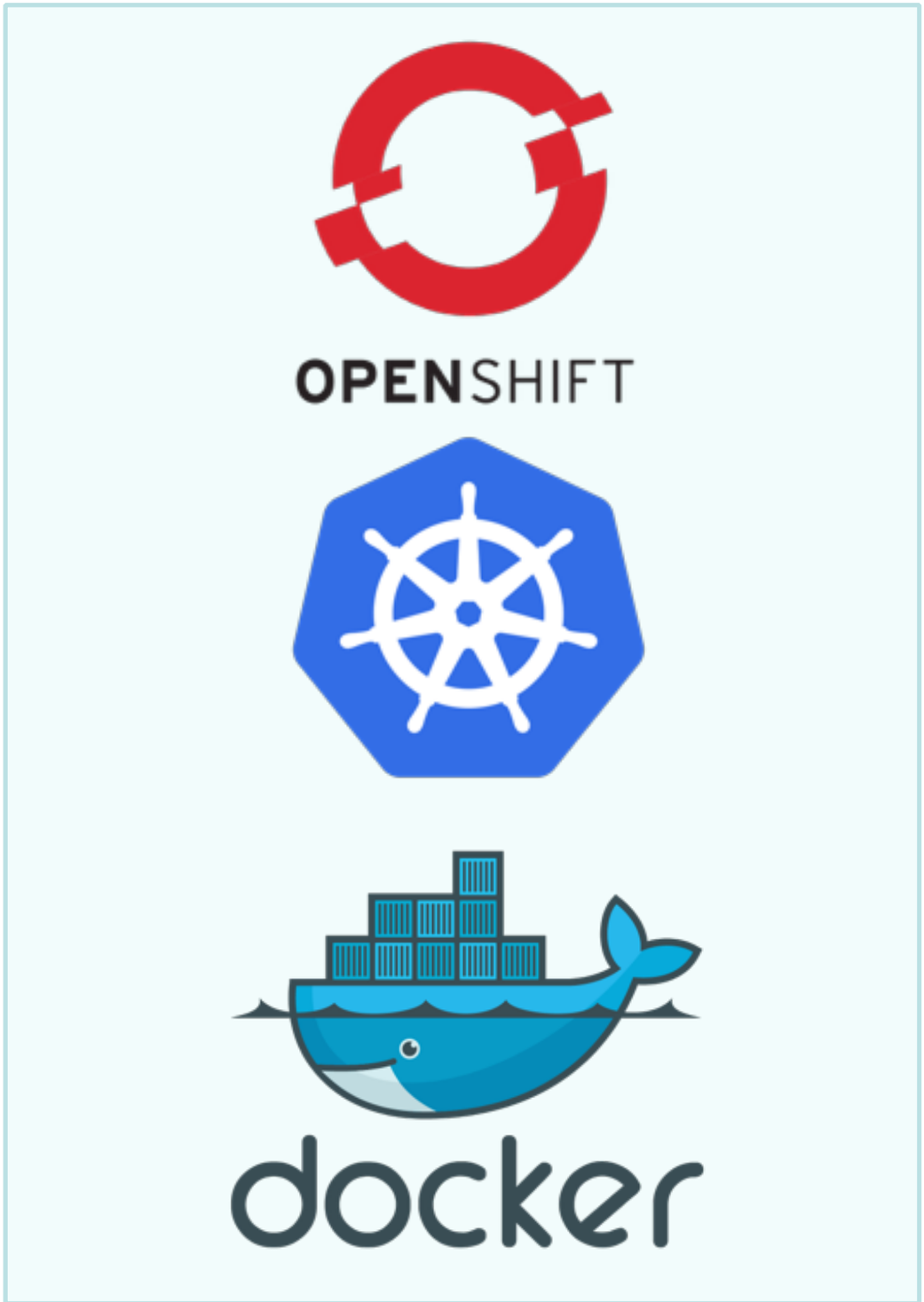


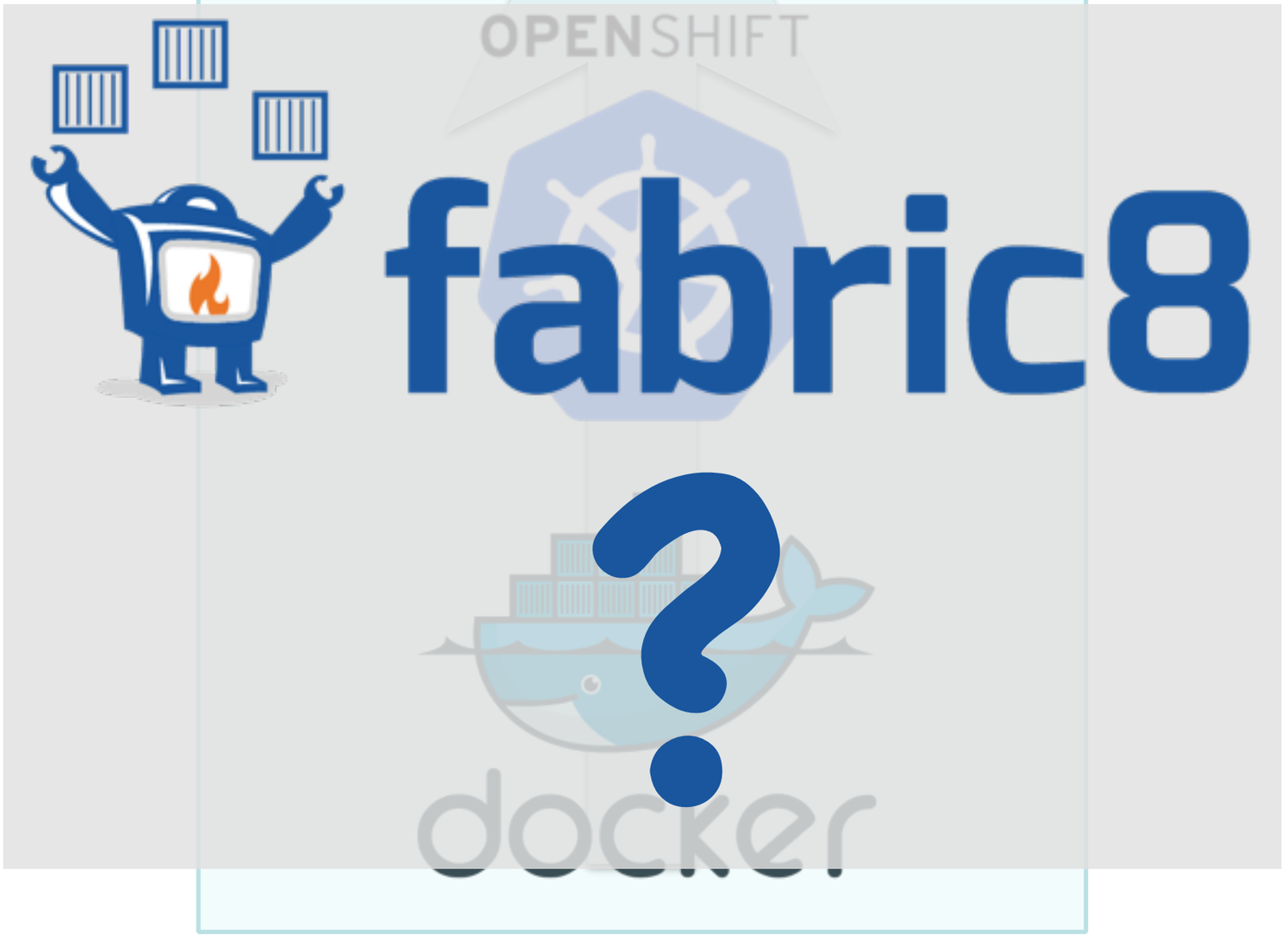


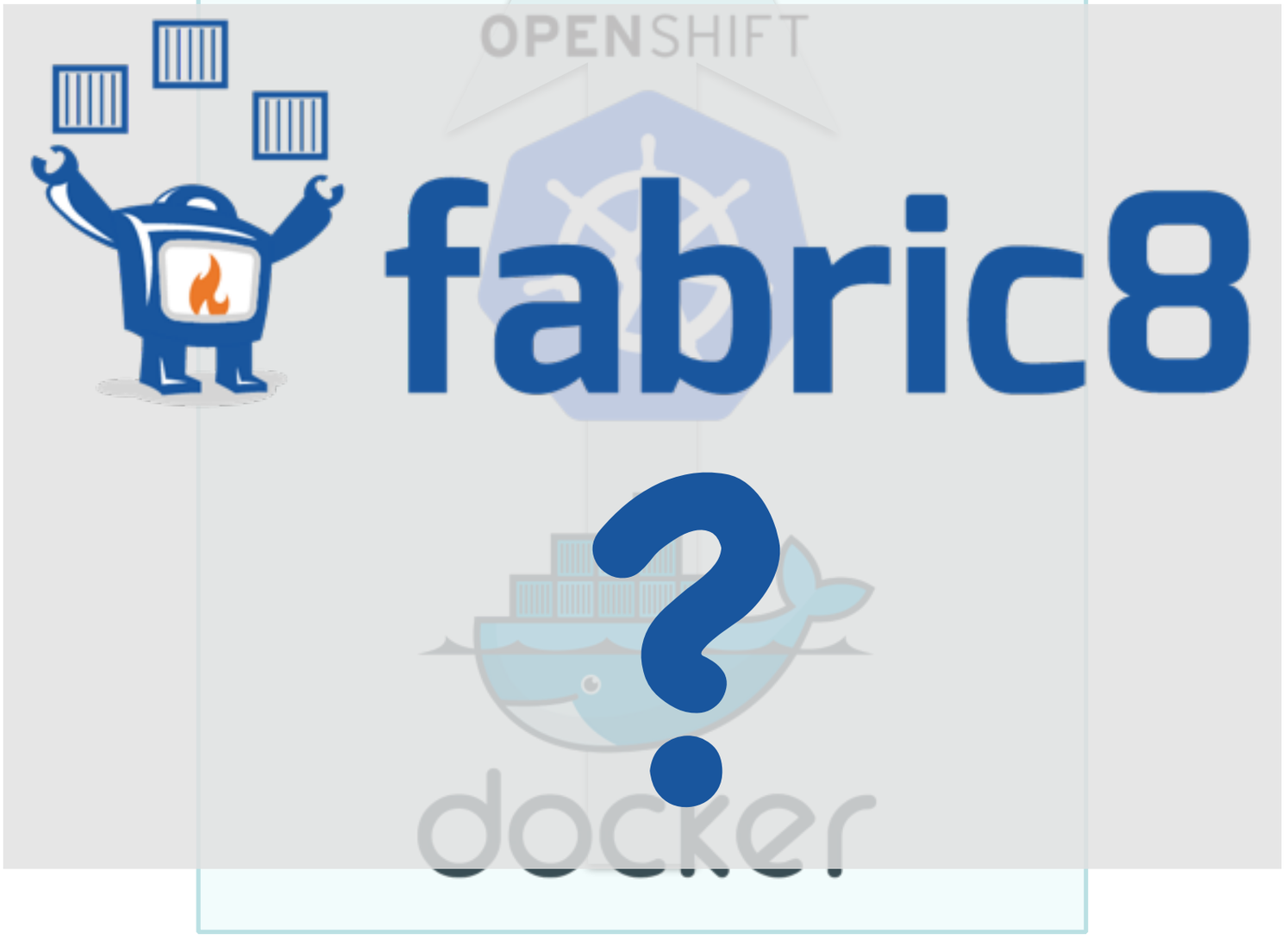
OPENSHIFT

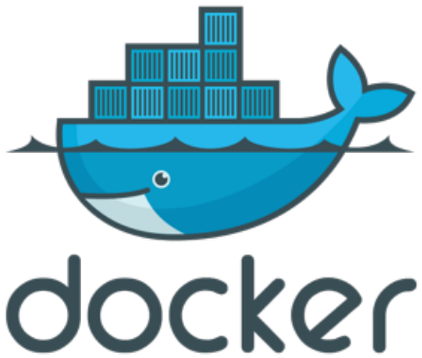


CLOUD FOUNDRY


OPENSHIFT
docker


OPENSHIFT
fabric8
?
docker


OPENSHIFT
fabric8
?
docker



OS Level Virtualization

Docker Orchestration

PaaS Platform on top of Kubernetes

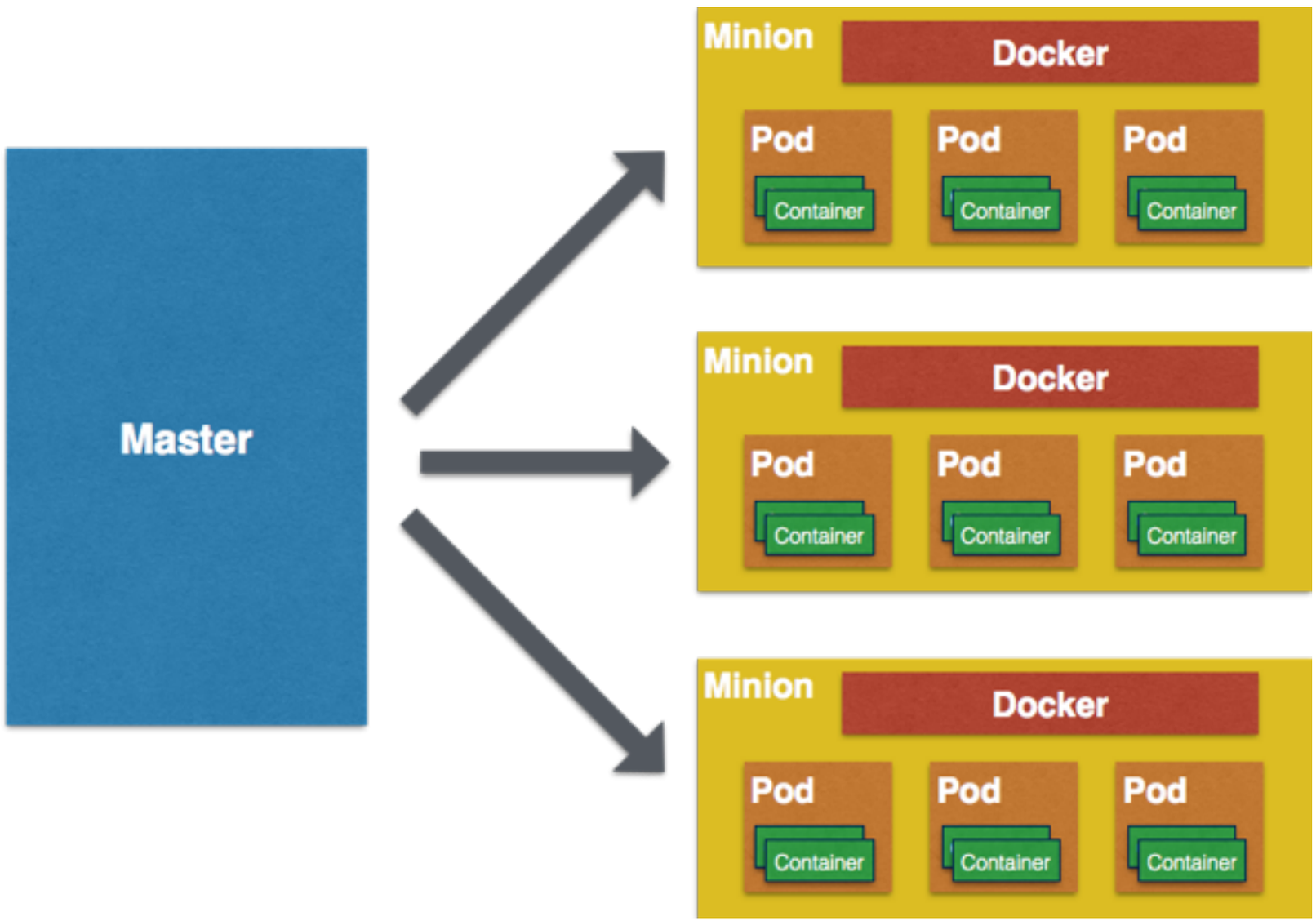
Services and Tools for Kubernetes and OpenShift

Kubernetes

Kubernetes

- Open Source orchestration platform for Docker containers
  - Rewrite of Google's internal framework "Borg"
- Declarative specification of a desired state
  - Self-healing
  - Service discovery
  - Scheduling across hosts
  - Replication

Architecture

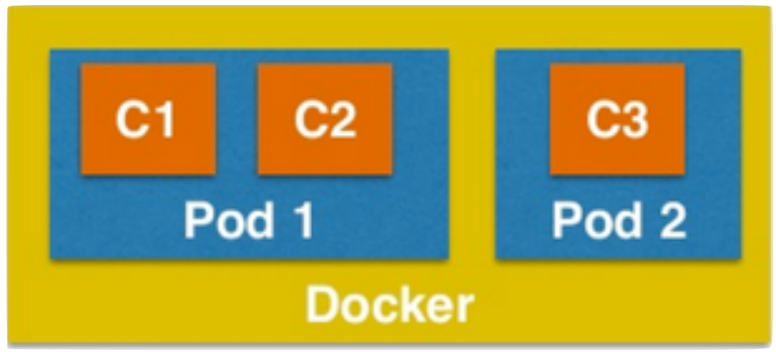


Key Concepts

- **Nodes**
  - Worker machine (physical or VM) running pods
- **Pods**
  - Collection of one or more Docker containers
- **Replication Controller**
  - Creates and takes care of Pods
- **Services**
  - Network Proxy for a collection of Pods
- **Labels**
  - Grouping and organization of Objects
- **Namespaces**
  - Virtual clusters backend by same physical cluster

Pod

- Collection of Docker containers running on the same host.
- Pods have unique IPs
- Containers in a Pod ….
  - …. share the same IP address
  - …. can reach each other via local ports
  - …. can share data via volumes
- Pods can have one or more ***Labels***

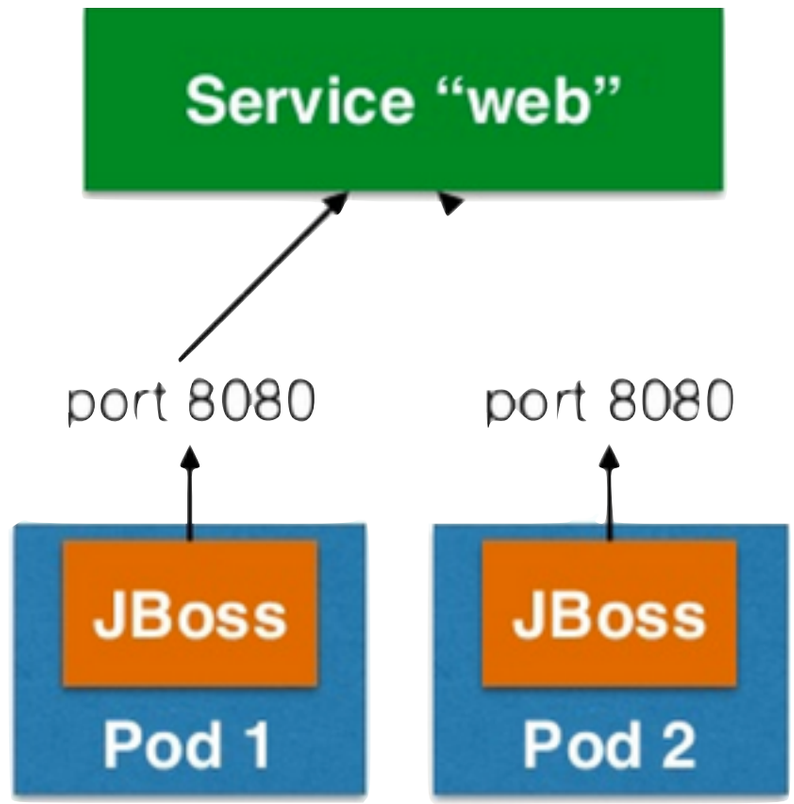


Replication Controller

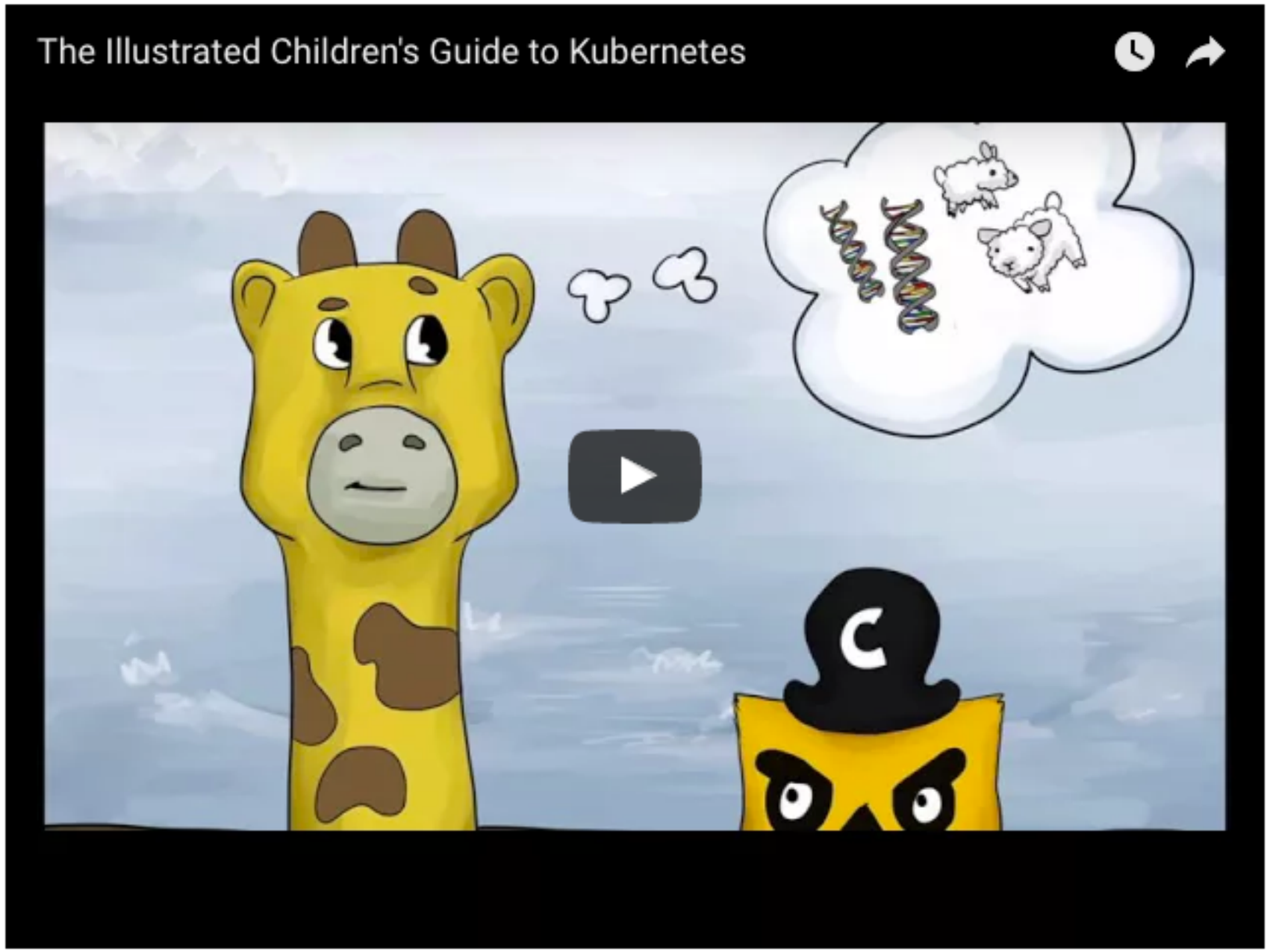
- Controls Pods selected by **Labels**
- Ensures that a specified number of Pod replicas is running
- Holds Pod templates for creating new Pods
- Autoscaling
- Rolling Updates

Service

- View on a set of Pods with single IP address and port
- Pods are selected by **Label**
- Services are referenced by environment variables
- Service addresses stay stable
  - Pods come and go (with different IPs)



What is Kubernetes?



http://blog.kubernetes.io/2016/06/illustrated-childrens-guide-to-kubernetes.html

fabric8

https://fabric8.io/

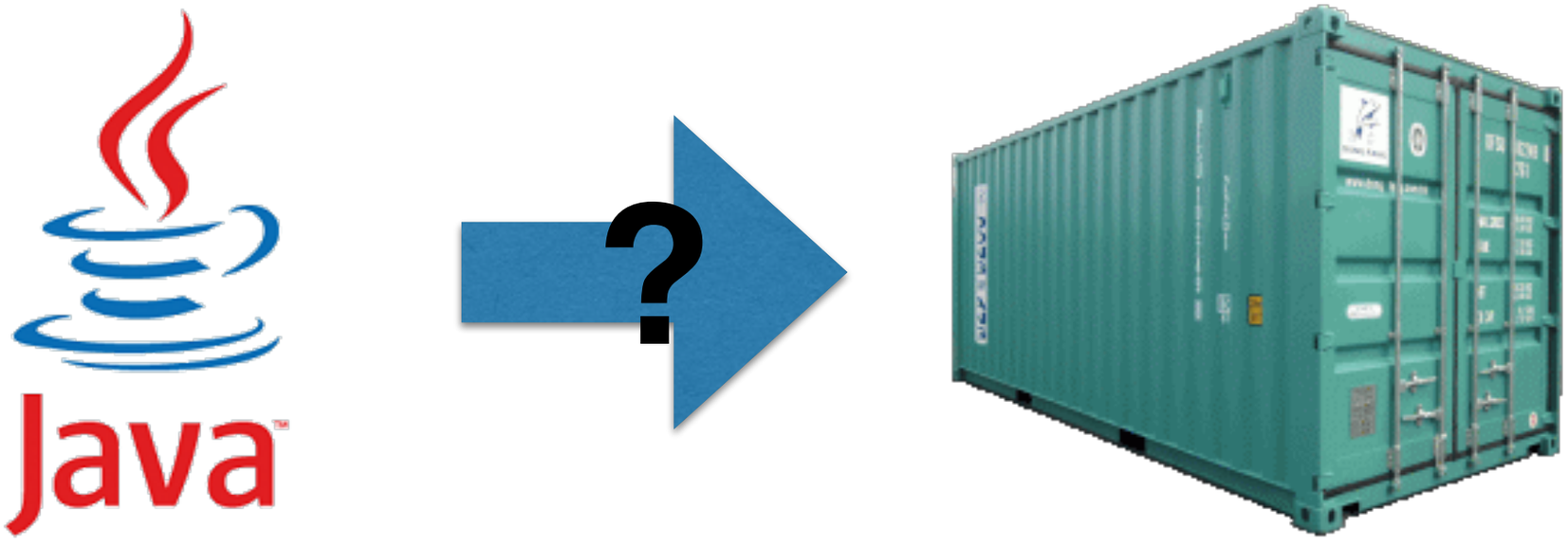
fabric8

- Opinionated microservices platform based on Docker, Kubernetes and Jenkins
  - **Management**: console, logging, metrics, dashboards, …
  - **Continuous Delivery** Pipeline
  - **iPaaS**: Camel route visualization, API registry, Messaging as a Service, …
  - **Tools**: Kubernetes/OpenShift build integration, Kubernetes component test support, CDI extensions
  - **Quickstarts**: Ready to use examples, also available as Maven archetypes

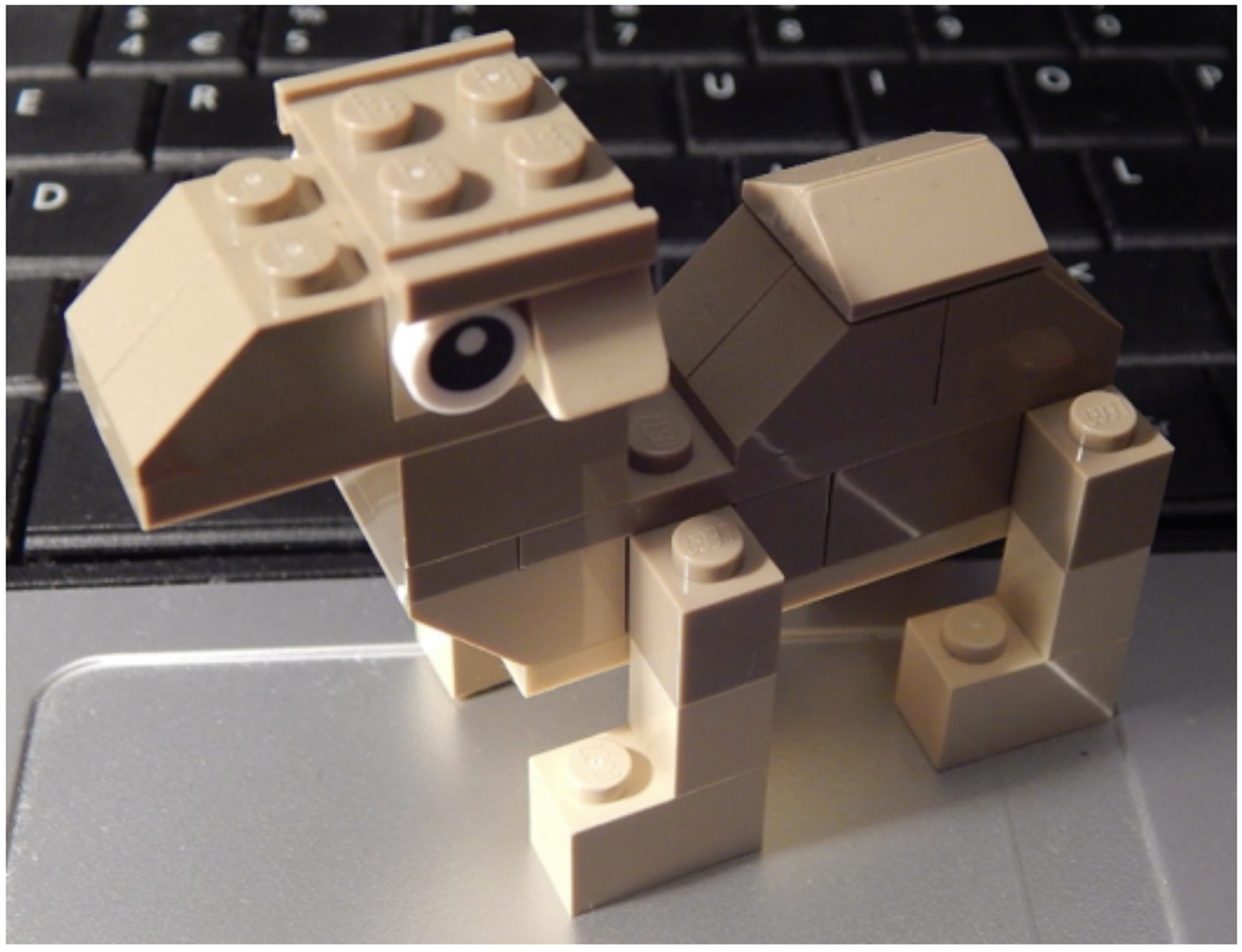
Kubernetes

Demo Time

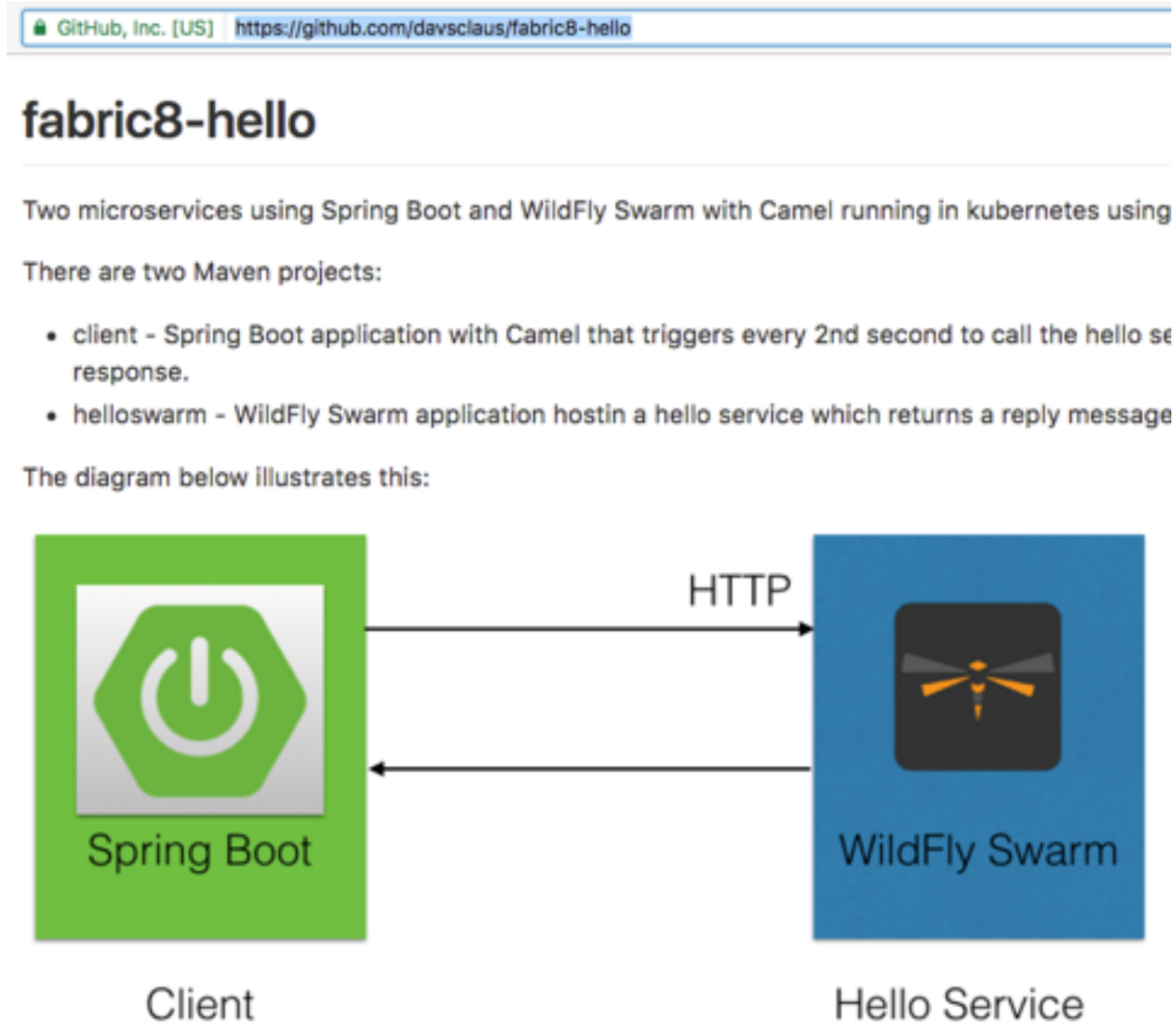
Java Developer



Build a Camel Demo Time



Source Code



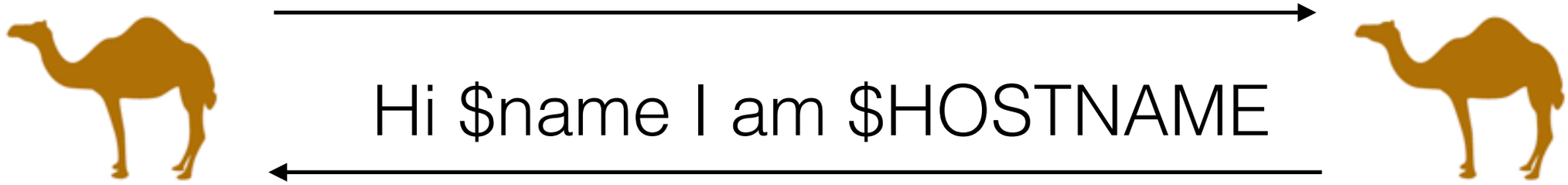
https://github.com/davsclaus/fabric8-hello

Hello Service

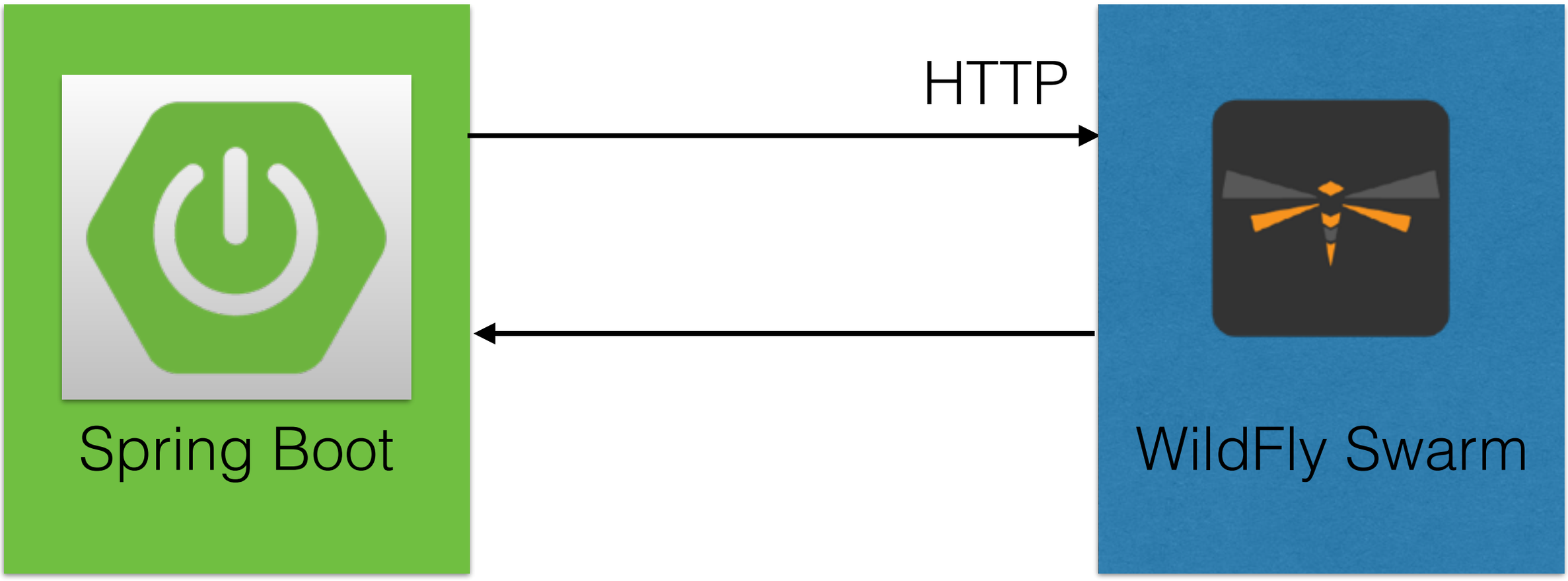
Client

Hello
Service

Hello Service



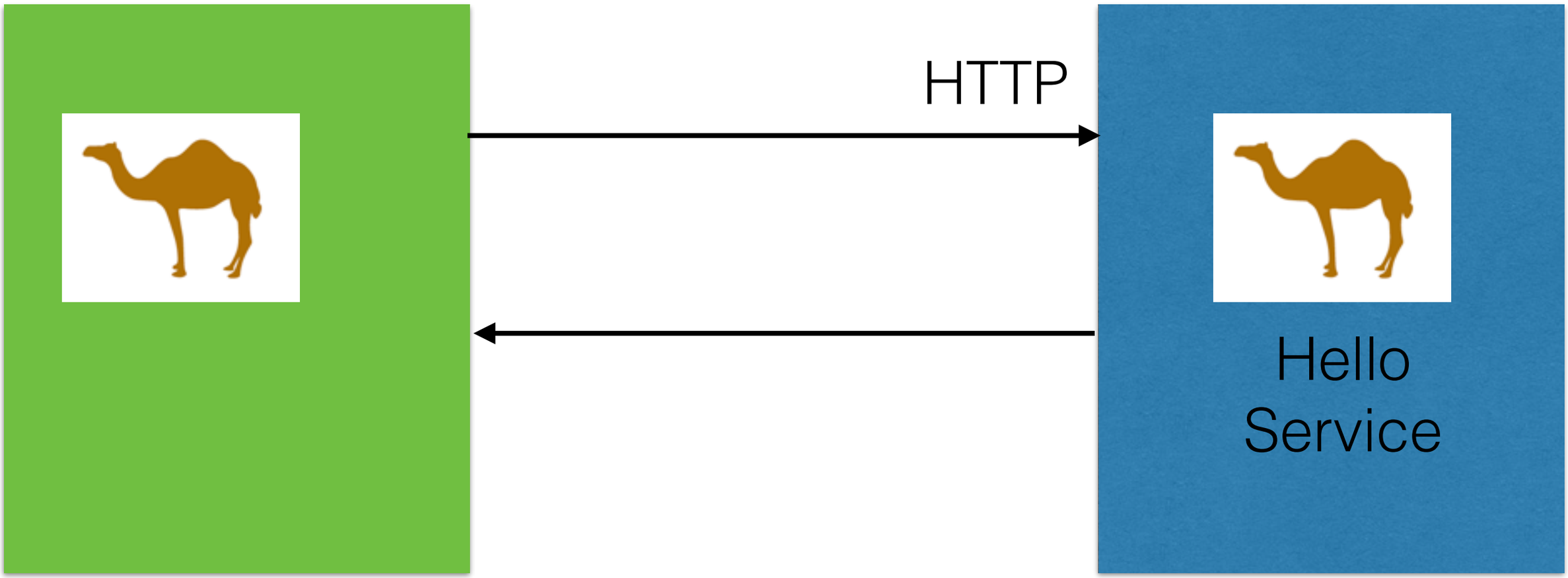
Implementation



Client

Hello Service

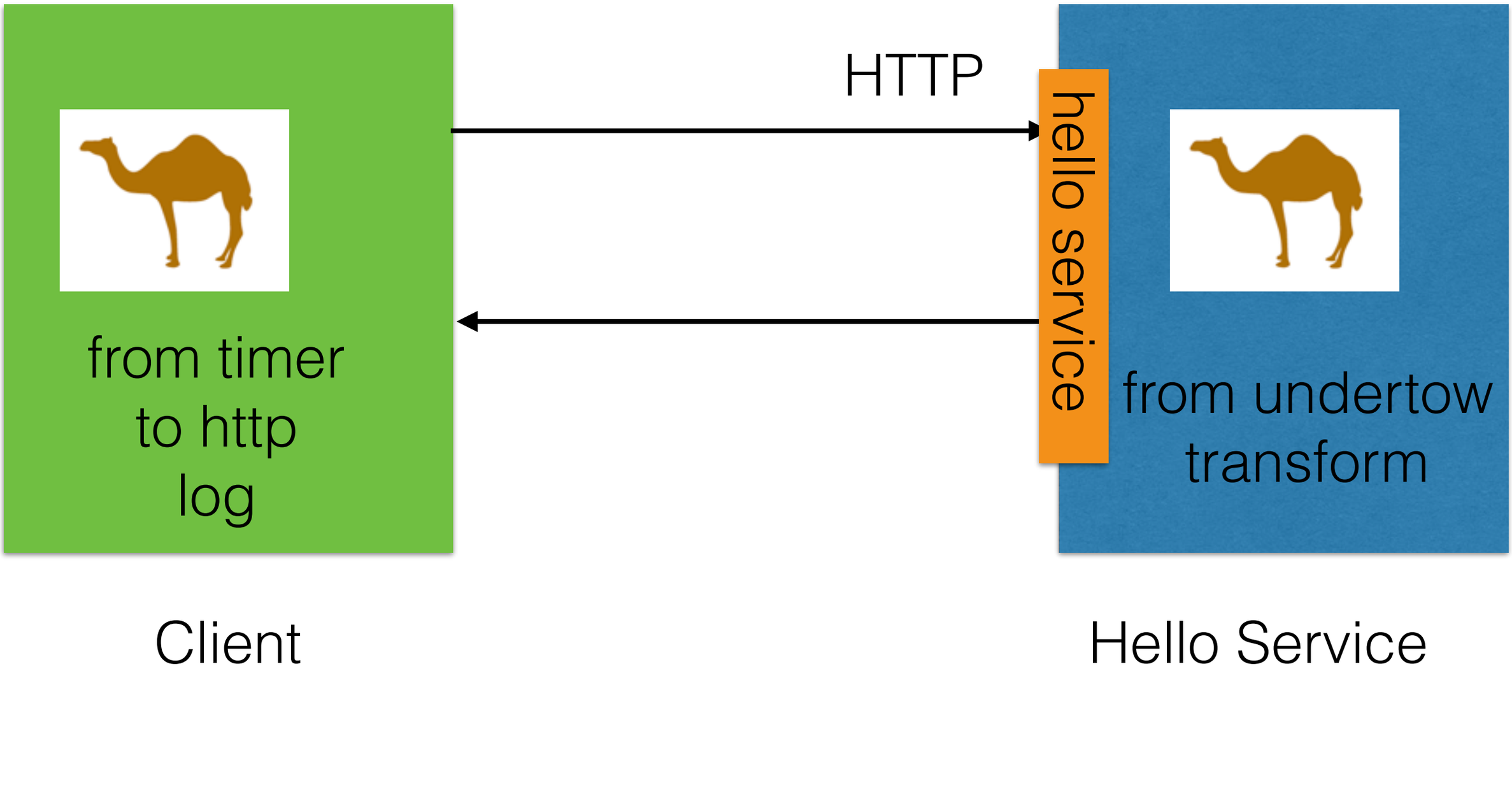
Implementation



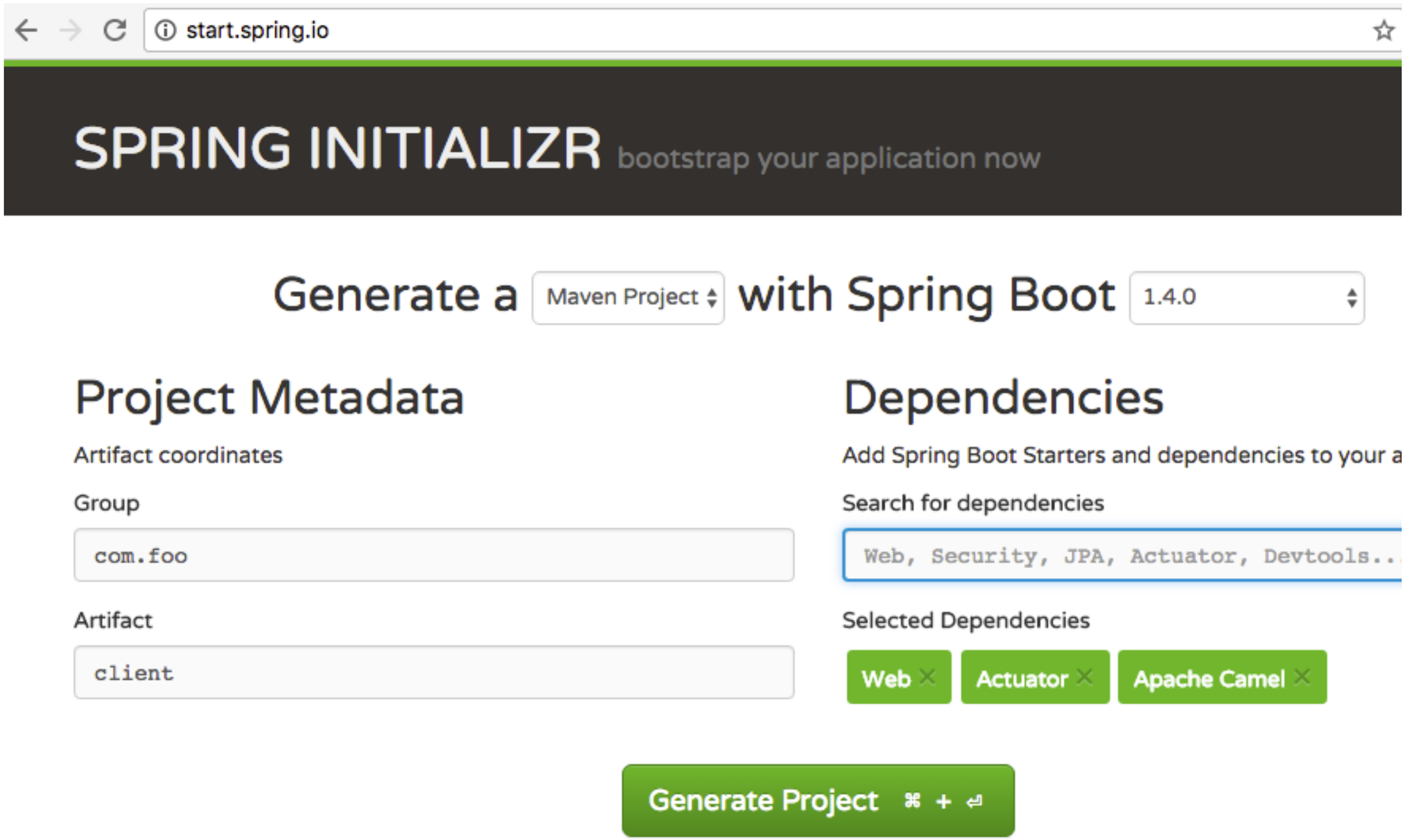
Client

Hello Service

Implementation



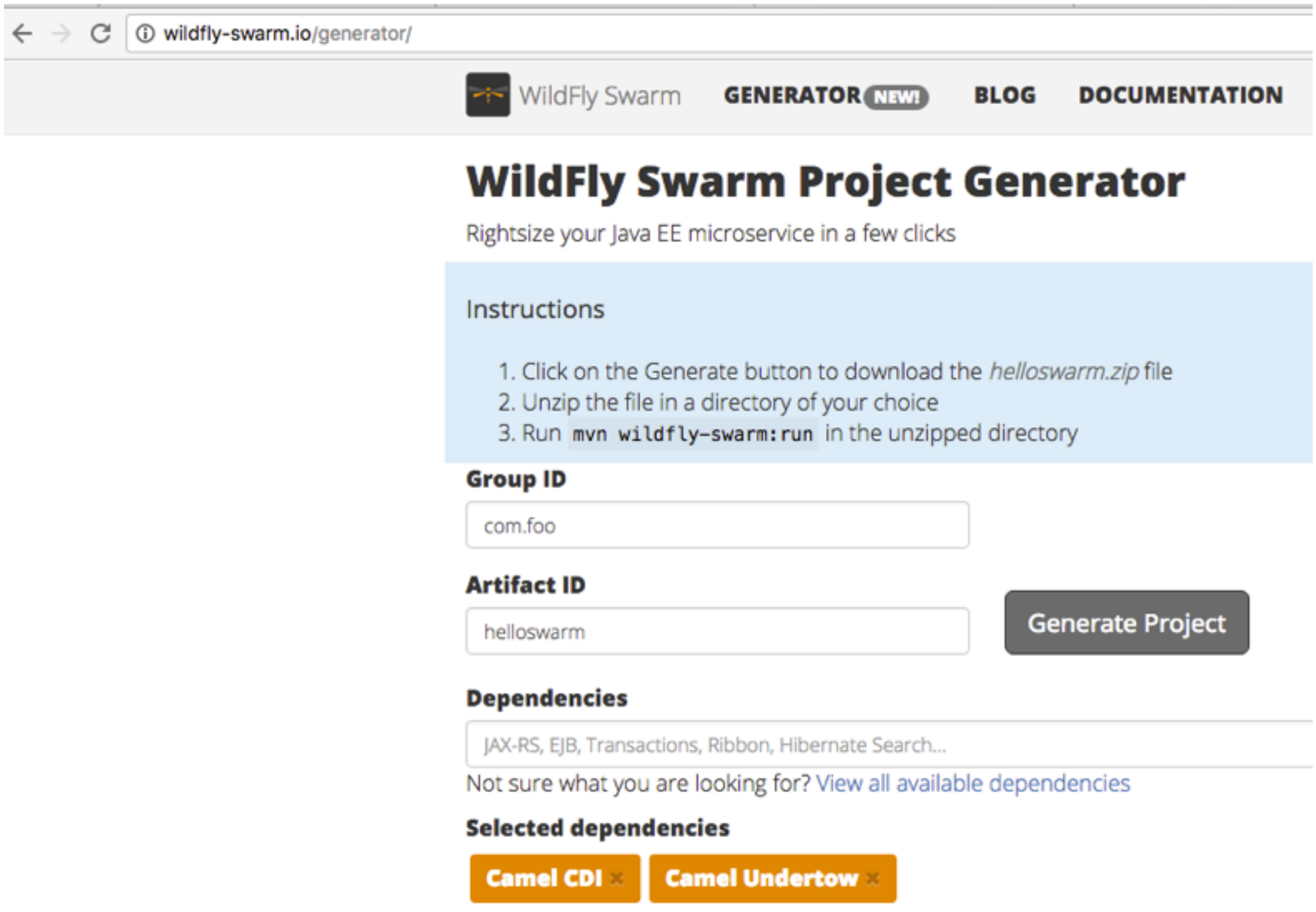
Spring Boot Starter



Client

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from("timer:foo?period=2000")
            .to("netty4-http:http://localhost:8080/hello")
            .log("${body}");
    }
}
```

WildFly Swarm Generator



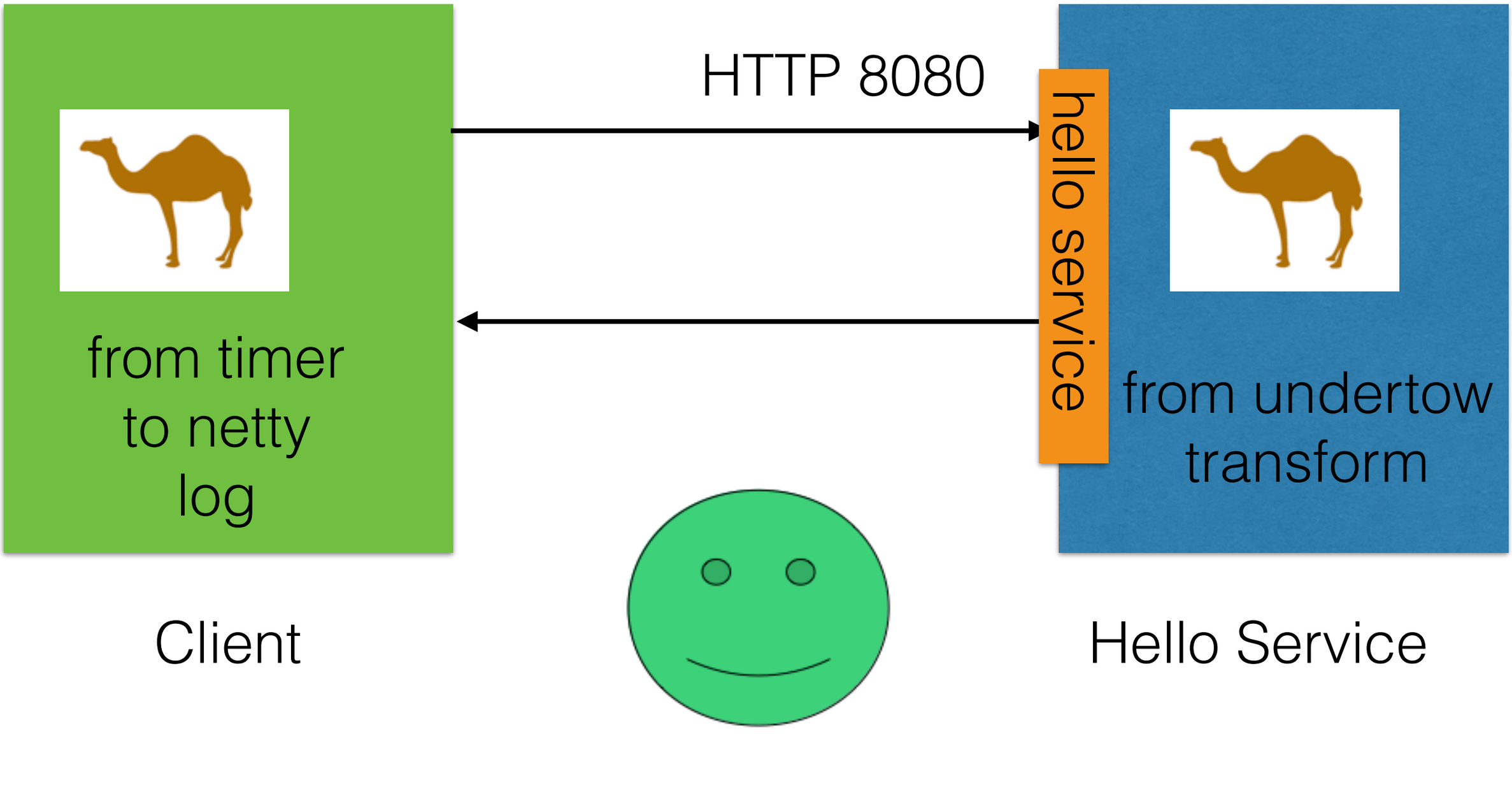
Hello Service

```
@Singleton
public class HelloRoute extends RouteBuilder {

    @Inject
    @Uri("undertow:http://0.0.0.0:8080/hello")
    private Endpoint undertow;

    @Inject
    private HelloBean hello;

    @Override
    public void configure() throws Exception {
        from(undertow).bean(hello);
    }
}
```

Hello Service

```
@Singleton
public class HelloBean {

    public String sayHello() throws Exception {
        return "Swarm says hello from "
                + InetAddressUtil.getLocalHostName();
    }
}
```

Ready to run local



How to build Docker Image?

Maven Project

Docker Image

Docker Maven Plugin

https://maven.fabric8.io

Fabric8 Maven Plugin

```xml
<plugin>
  <groupId>io.fabric8</groupId>
  <artifactId>fabric8-maven-plugin</artifactId>
  <version>3.1.37</version>
</plugin>
```

https://maven.fabric8.io

Install fabric8-maven-plugin

```
mvn io.fabric8:fabric8-maven-plugin:3.1.37:setup
```

https://maven.fabric8.io

Fabric8 Maven Plugin

```xml
<plugin>
  <groupId>io.fabric8</groupId>
  <artifactId>fabric8-maven-plugin</artifactId>
  <version>3.1.32</version>
  <executions>
    <execution>
      <id>fmp</id>
      <goals>
        <goal>resource</goal>
        <goal>helm</goal>
        <goal>build</goal>
      </goals>
    </execution>
  </executions>
</plugin>
```

Build Docker Image

mvn package fabric8:build

```
[INFO] --- fabric8-maven-plugin:3.1.32:build (fmp) @ client ---
[INFO] F8> Running in Kubernetes mode
[INFO] F8> Running generator spring-boot
[INFO] F8> Running generator java-exec
[INFO] F8> Pulling from fabric8/java-alpine-openjdk8-jdk
e110a4a17941: Pull complete
deb4805e2548: Pull complete
04712c369ba1: Pull complete
2c82593e8eb2: Downloading [==================================================>] 49.54 MB/49.68 MB
58bb43a36a2e: Download complete
a2f01f9f1b00: Download complete
e6f2f9c9e249: Download complete
179ec0f1d75a: Download complete
61cbb3b63095: Download complete
5bd50883c949: Download complete
```

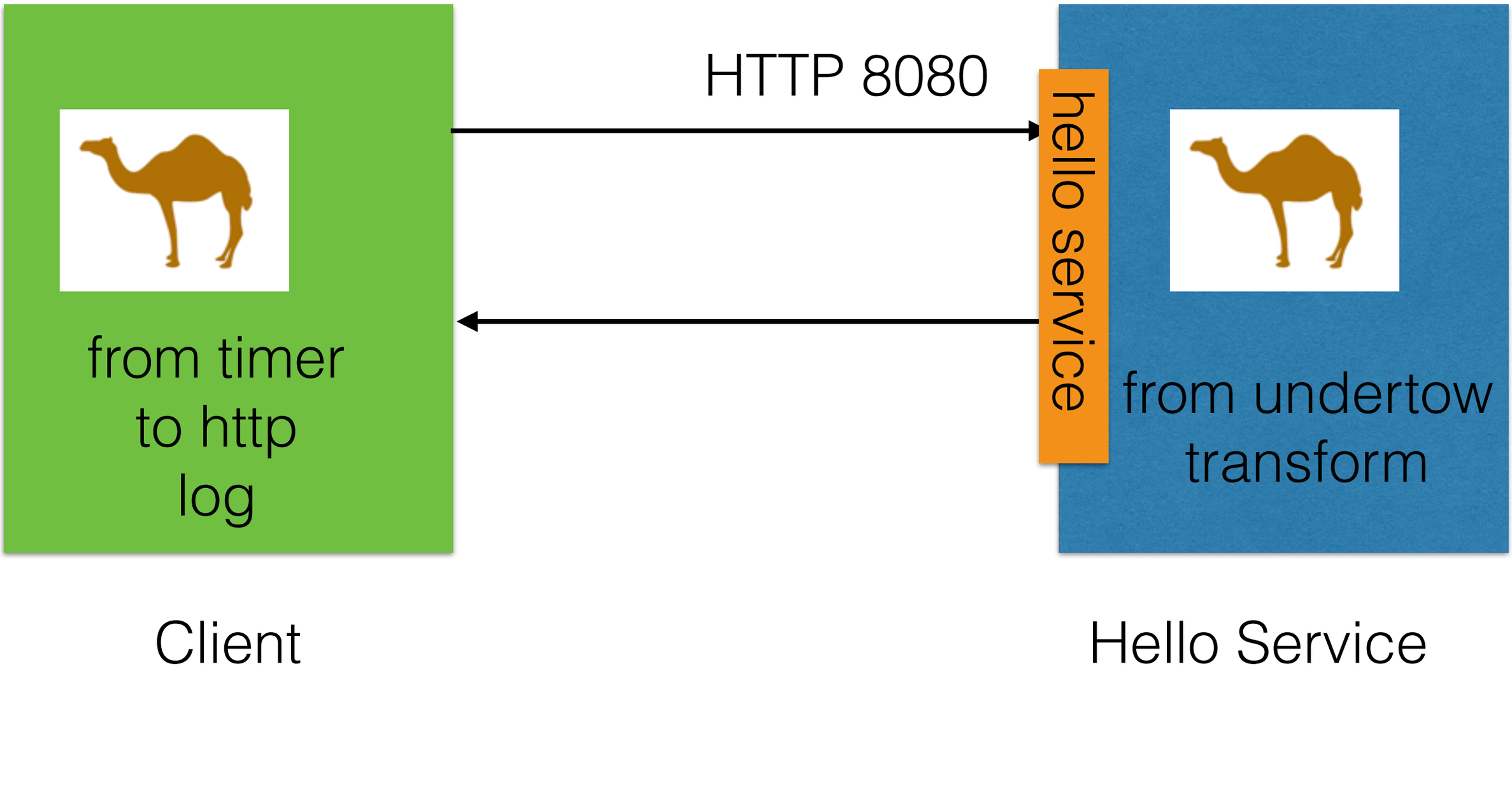
Local Docker Repository

Hello Service

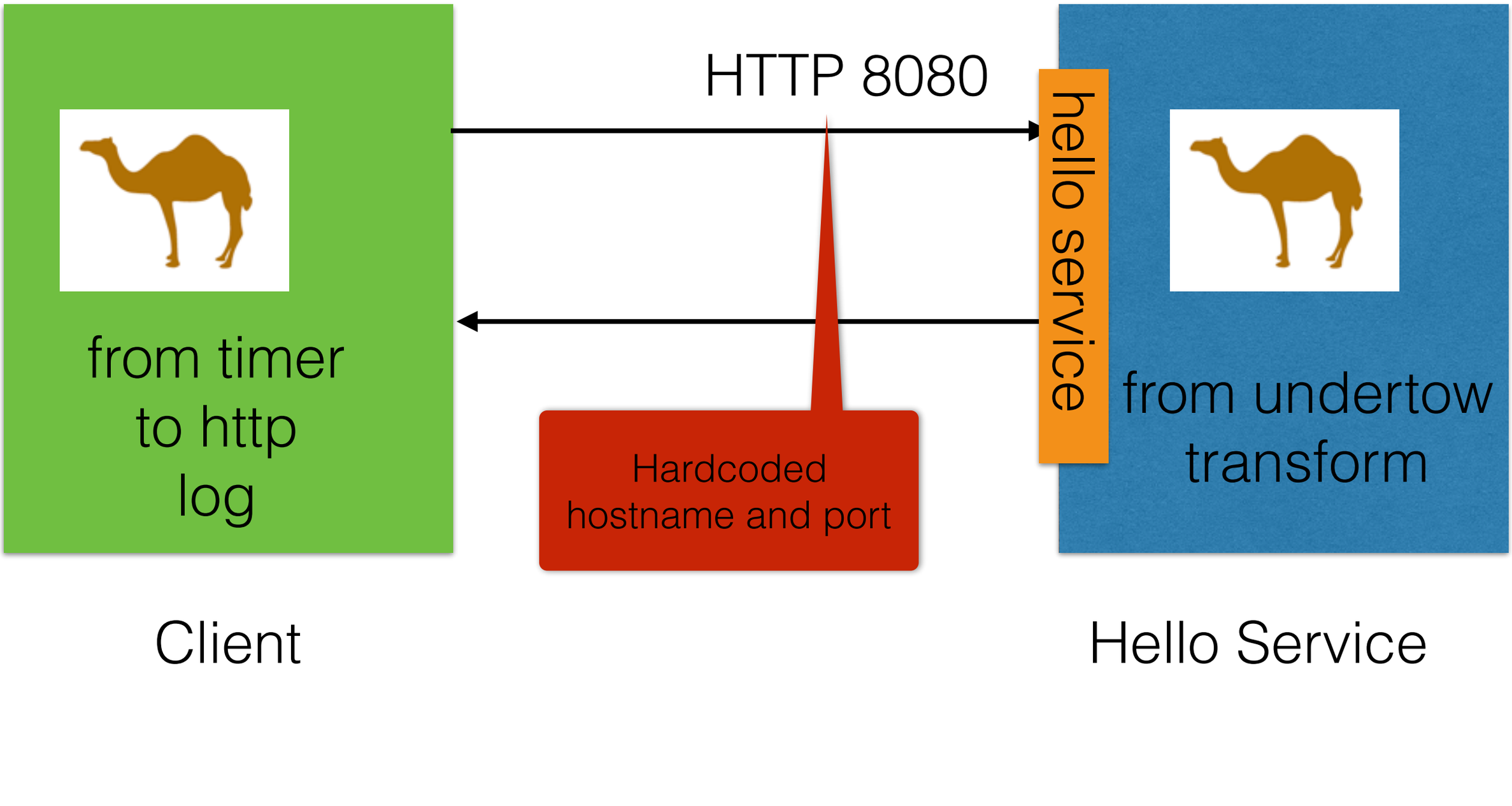
Client

```
davsclaus:/Users/                    ocuments/workspace/client/$ docker images
REPOSITORY                                   TAG                 IMAGE ID
foo/helloswarm                               latest              f572db11fc2e
foo/client                                   latest              c16cac32bf39
openshift/origin-deployer                    v1.3.0-rc1          7e0bab2a9a21
openshift/orig      -pod                     v1.3.0-rc1          ea67ec68a53a
fabric8/exposec                              latest              7e2e98c75db5
fabric8/fabric8                              2.2.174             efb7bc509cb0
fabric8/java-al          openjdk8-jdk        latest              c9139d27b712
```

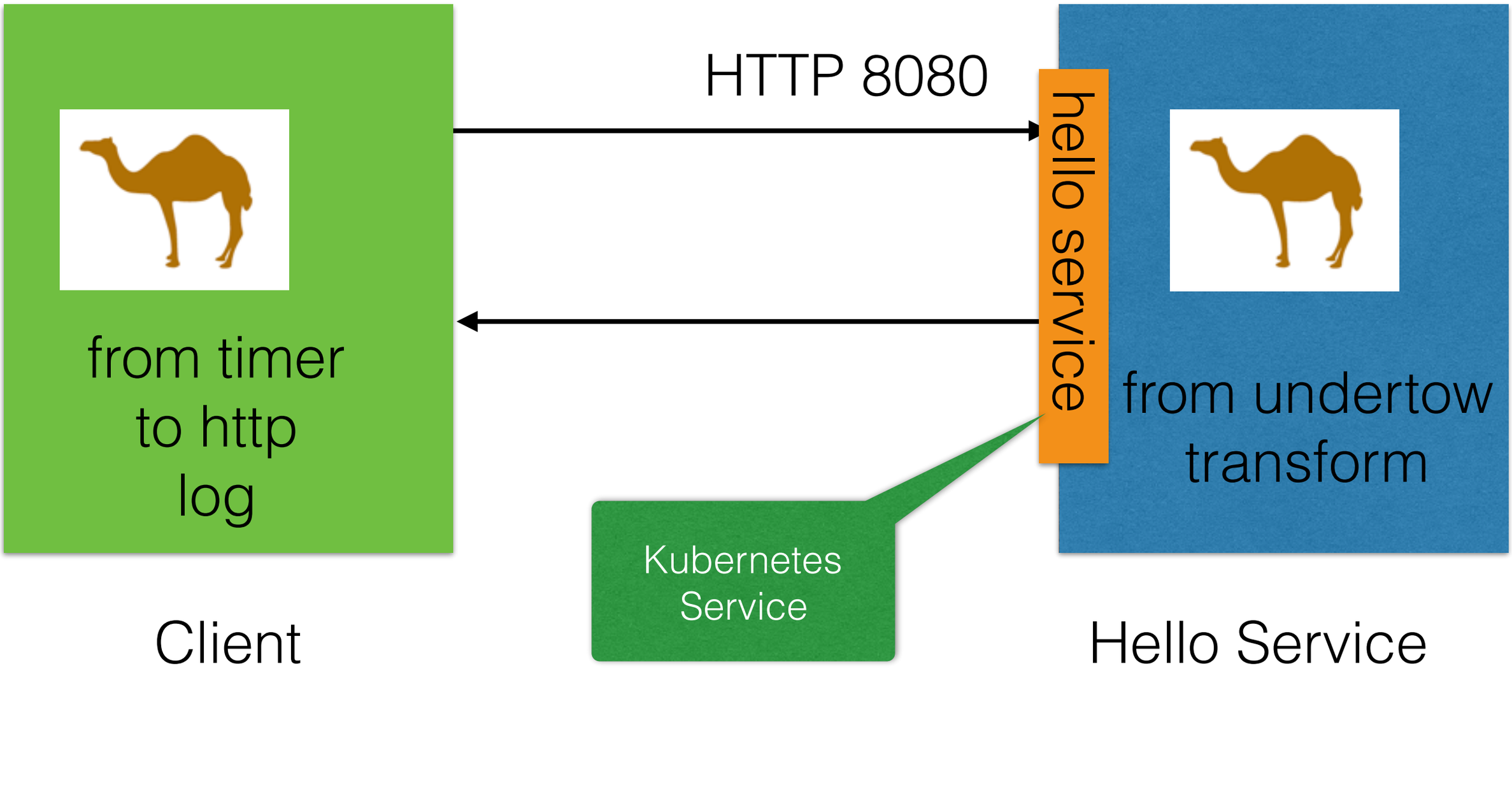
Our Demo


HTTP 8080
hello service
from timer
to http
log
from undertow
transform
Client
Hello Service

Static vs Dynamic Platform



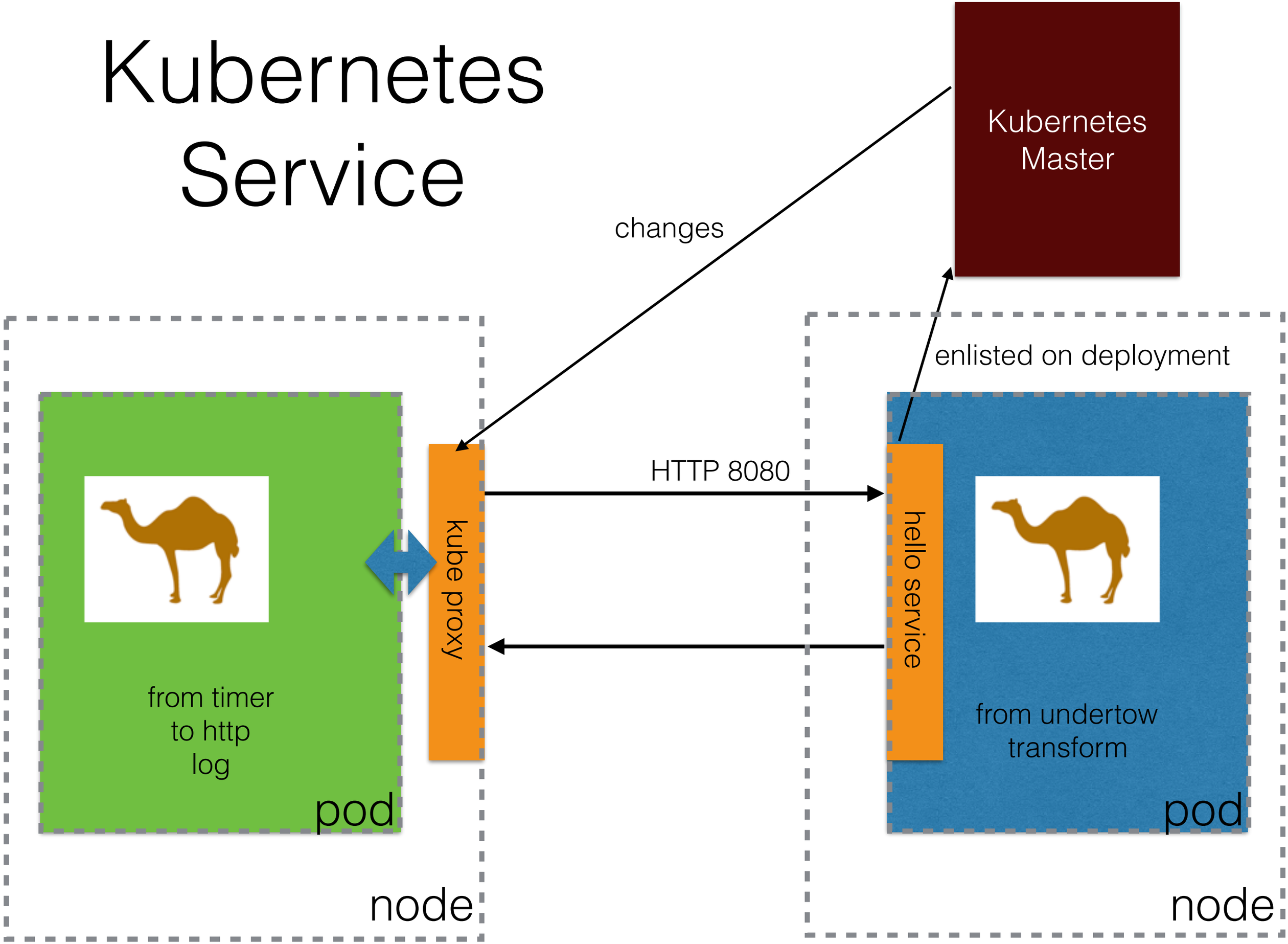
Dynamic Platform



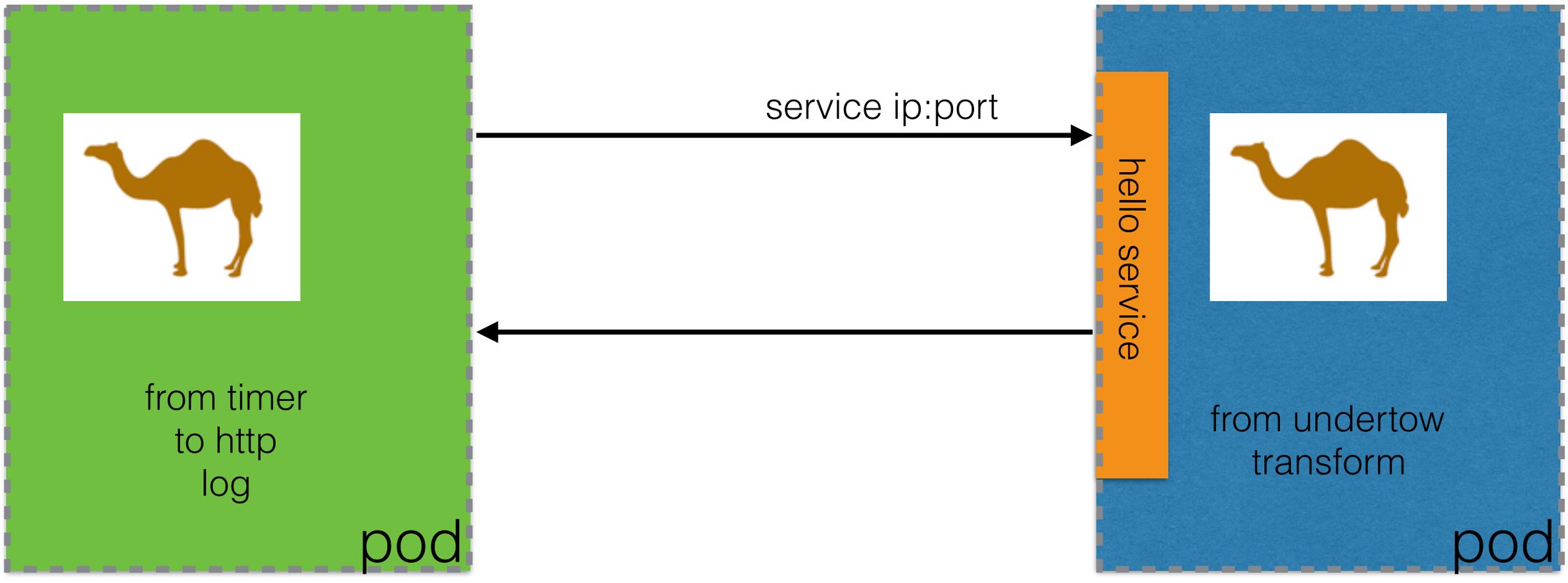
Kubernetes Service

- Network Connection to one or more Pods
- Unique static IP and port (lifetime of service)

Kubernetes Service



Kubernetes Service from user point of view



Out of the box service

```
  name: "helloswarm"
spec:
  ports:
  - port: 8080
    protocol: "TCP"
    targetPort: 8080
```

Maven artifactId

WildFly Swarm
HTTP port

Custom Configured Service service.yml

```yaml
metadata:
  annotations:
    api.service.kubernetes.io/path: /hello
  name: "hello"
spec:
  ports:
  - port: 8181
    protocol: "TCP"
    targetPort: 8080
  type: LoadBalancer
```

Service Name

Service Port = Outside

Container Port = Inside

Using Kubernetes Service

from timer
to http
log

Client

We want to use hello service

How do we do that?

Using Kubernetes Service

- Environment Variables
  - Hostname
  - Port

```
export HELLO_SERVICE_HOST='172.30.6.19'
export HELLO_SERVICE_PORT='8181'
```

Service Discovery using DNS is available
in newer versions of Kubernetes.

Service using ENV

Client

- Use ENV

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from("timer:foo?period=2000")
                .to("netty4-http:http://{{service:hello}}/hello")
                .log("${body}");
    }
}
```

Service using DNS

Client

- Use DNS

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from("timer:foo?period=2000")
                .to("netty4-http:http://hello:8181/hello")
                .log("${body}");
    }
}
```

Service using DNS

from timer
to http
log

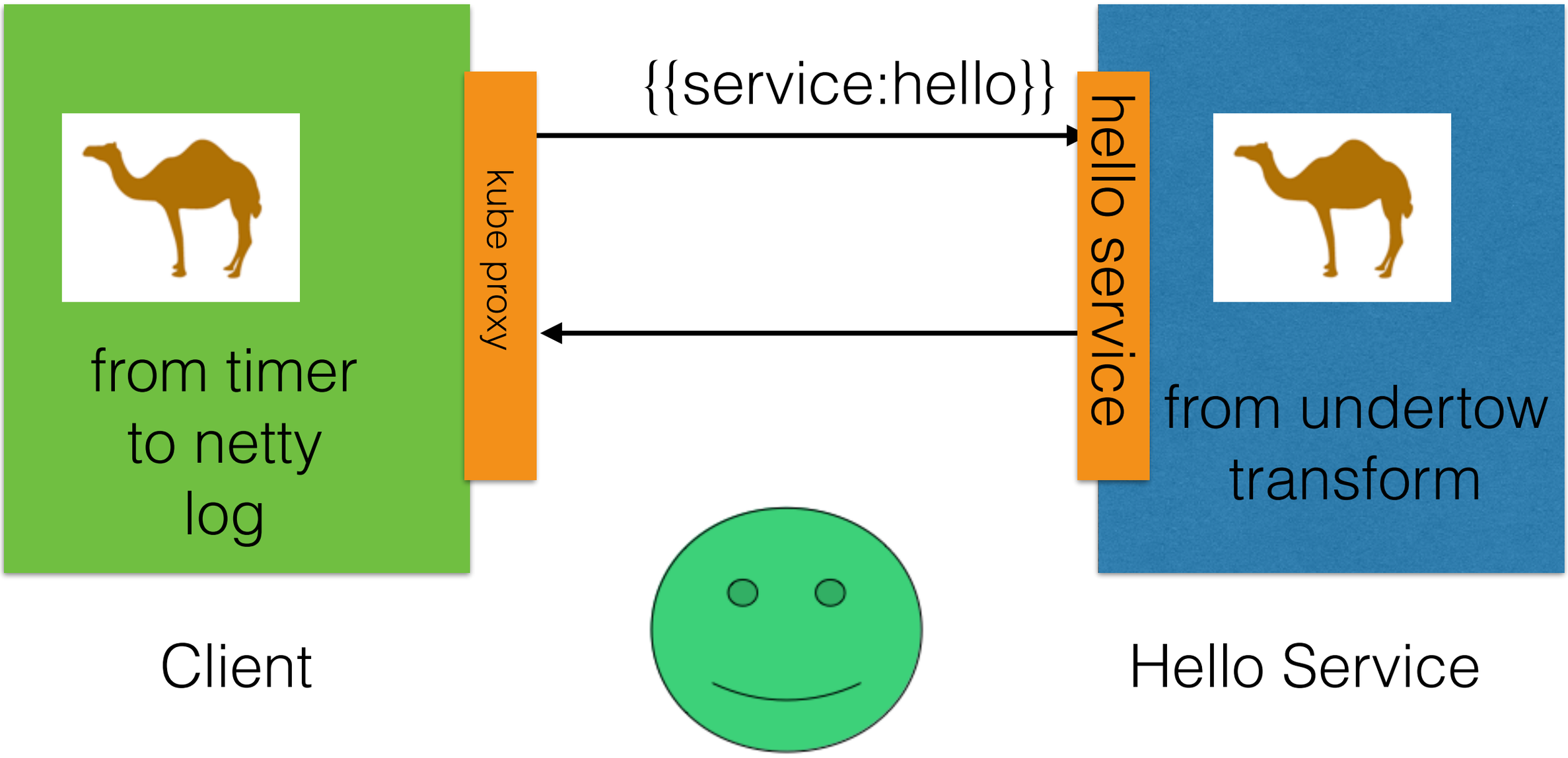
Client

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from("timer:foo?period=2000")
                .to("netty4-http:http://hello:8181/hello")
                .log("${body}");
    }
}
```

Kubernetes Service

```
metadata:
  annotations:
    api.service.kubernetes.io/path: /hello
  name: "hello"
spec:
  ports:
  - port: 8181
    protocol: "TCP"
    targetPort: 8080
  type: LoadBalancer
```

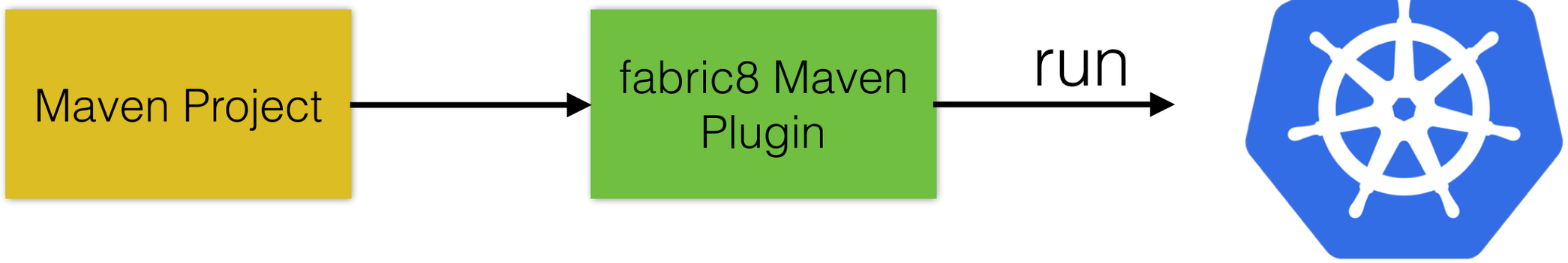
Ready to run in Kubernetes



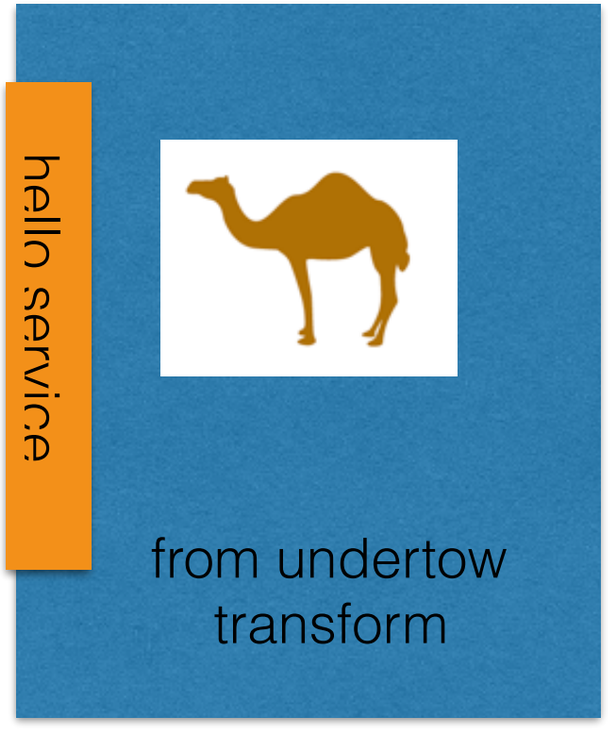
How to deploy to Kubernetes?

Maven Project

How to deploy to Kubernetes?



Deploy - Hello Service



Hello Service

- mvn fabric8:run

```
davsclaus:/Users/davsclaus/Documents/workspace/helloswarm/$ mvn fabric8:run
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building Wildfly Swarm Example 1.0-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO]
[INFO] >>> fabric8-maven-plugin:3.1.32:run (default-cli) > install @ helloswa
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @ hellosw
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] Copying 1 resource
[INFO]
[INFO] --- fabric8-maven-plugin:3.1.32:resource (fmp) @ helloswarm ---
[INFO] F8> Running in Kubernetes mode
```

Deploy - Client

Client

- mvn fabric8:run

```
davsclaus:/Users/davsclaus/Documents/workspace/client/$ mvn fabric8:run
[INFO] Scanning for projects...
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] Building client 1.0-SNAPSHOT
[INFO] ------------------------------------------------------------------------
[INFO]
[INFO] >>> fabric8-maven-plugin:3.1.32:run (default-cli) > install @ client >>>
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @ client ---
```

Running Kubernetes Locally

- MiniKube
- MiniShift
- Vagrant
- OpenShift CDK

https://fabric8.io/guide/getStarted/index.html

Running fabric8

- Download gofabric8

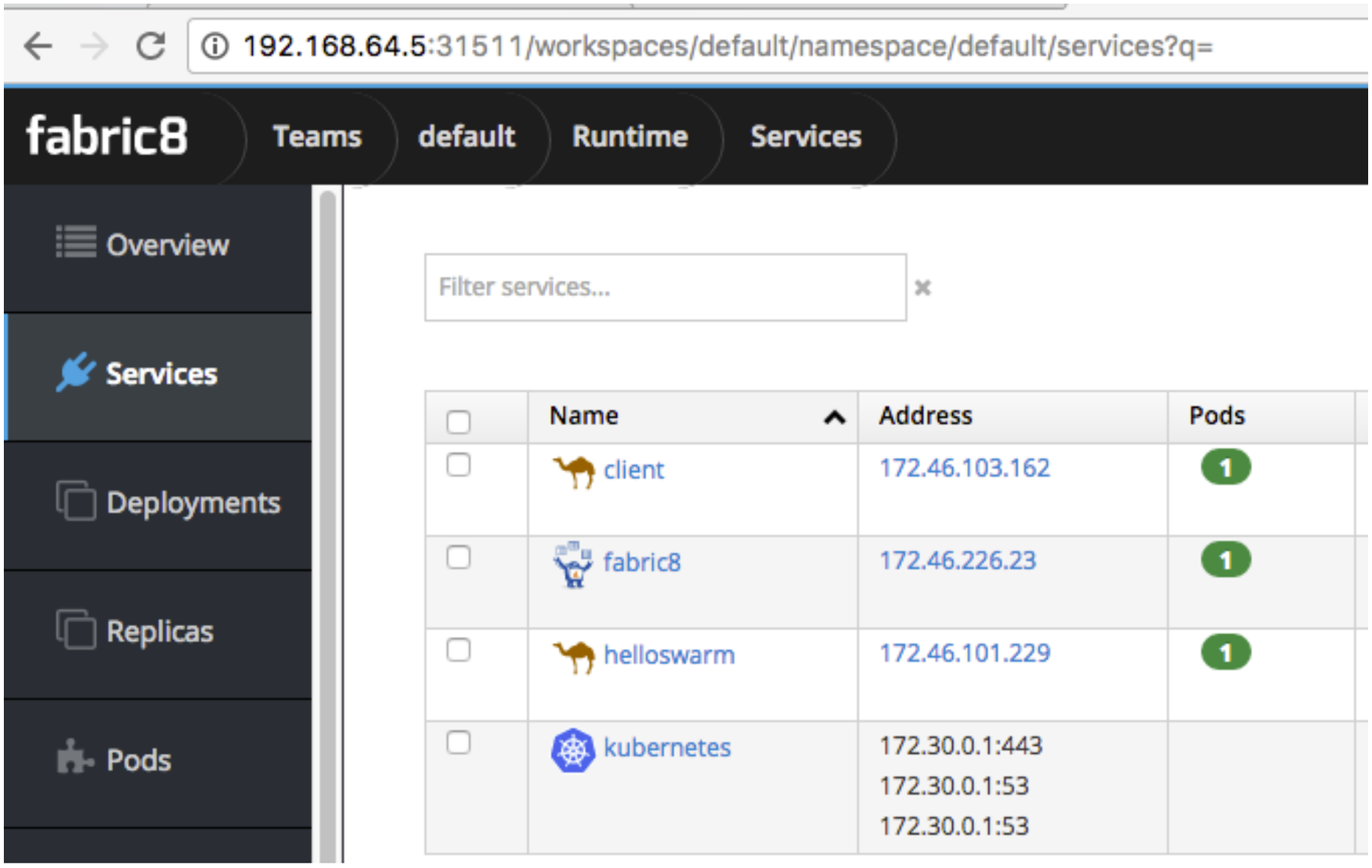
  https://github.com/fabric8io/gofabric8/releases

- Start fabric8

  gofabric8 start --minishift --console --memory=2000

https://fabric8.io/guide/getStarted/minishift.html

fabric8 Web Console



minishift service fabric8

OpenShift CLI

You can also use CLI from docker & kubernetes

- oc get pods

```
davsclaus:/Users/davsclaus/Documents/workspace/client/$ oc get pods
NAME                          READY     STATUS    RESTARTS   AGE
client-1-60c0o                1/1       Running   5          9m
exposecontroller-1-2fb1p      1/1       Running   0          35m
fabric8-cg8c0                 1/1       Running   0          36m
helloswarm-1-qcnv7            1/1       Running   0          14m
```

OpenShift CLI

- oc get service

```
davsclaus:/Users/davsclaus/Documents/workspace/$ oc get service
NAME          CLUSTER-IP      EXTERNAL-IP                          PORT(S)
client        172.30.14.254   172.46.103.162,172.46.103.162        8080/TCP
fabric8       172.30.140.79   172.46.226.23,172.46.226.23          80/TCP
hello         172.30.21.39    172.46.203.233,172.46.203.233        8181/TCP
kubernetes    172.30.0.1      <none>                               443/TCP,5
```

OpenShift CLI

- oc logs -f <pod name>

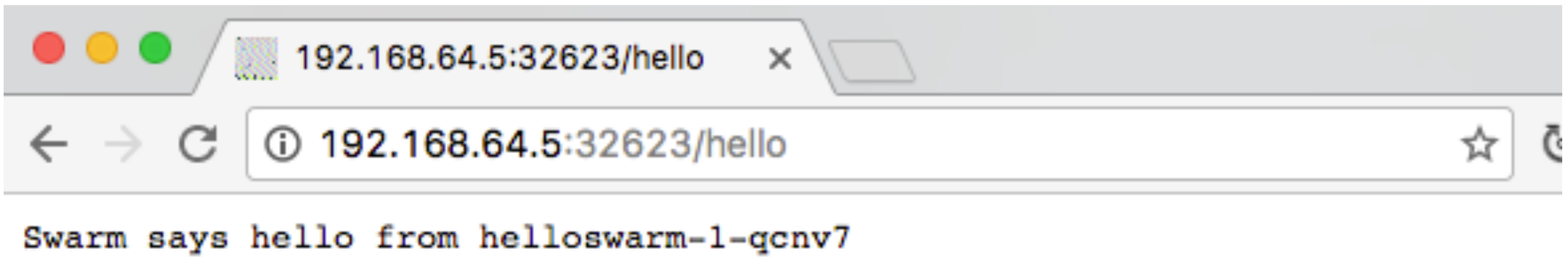
```
davsclaus:/Users/davsclaus/Documents/workspace/$ oc logs -f client-1-qlfym
I> No access restrictor found, access to any MBean is allowed
Jolokia: Agent started with URL http://172.17.0.3:8778/jolokia/
2016-09-09 13:07:33.604:INFO:ifasjipjsoejs.Server:jetty-8.y.z-SNAPSHOT
2016-09-09 13:07:33.649:INFO:ifasjipjsoejs.AbstractConnector:Started Select
```

```
  .   ____          _            __ _ _
 /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
 \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
  '  |____| .__|_| |_|_| |_\__, | / / / /
 =========|_|==============|___/=/_/_/_/
 :: Spring Boot ::        (v1.4.0.RELEASE)
```

```
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-qcnv7
```

Access Service from your laptop

- minishift service hello



Scaling

- Change deployment replicas

	Name	Pods	Scale
☐	client	1	1
☐	exposecontroller	1	1
☐	helloswarm	1	1

	Name	Pods	Scale
☐	client	1	1
☐	exposecontroller	1	1
☐	helloswarm	2	2

Scaling

Load balancing is random

- Service load balancing

```
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-665c1
Swarm says hello from helloswarm-1-665c1
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-665c1
Swarm says hello from helloswarm-1-665c1
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-665c1
Swarm says hello from helloswarm-1-665c1
Swarm says hello from helloswarm-1-665c1
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-qcnv7
Swarm says hello from helloswarm-1-665c1
```

Angry Pods

1st person shooter - Kill your pods

Links

@davsclaus
davsclaus
davsclaus.com

- fabric8
  - http://fabric8.io
- Demo source code
  - https://github.com/davsclaus/fabric8-hello
- Try kubernetes / fabric8
  - https://fabric8.io/guide/getStarted/minishift.html
- Videos, blogs and more
  - https://fabric8.io/community/index.html