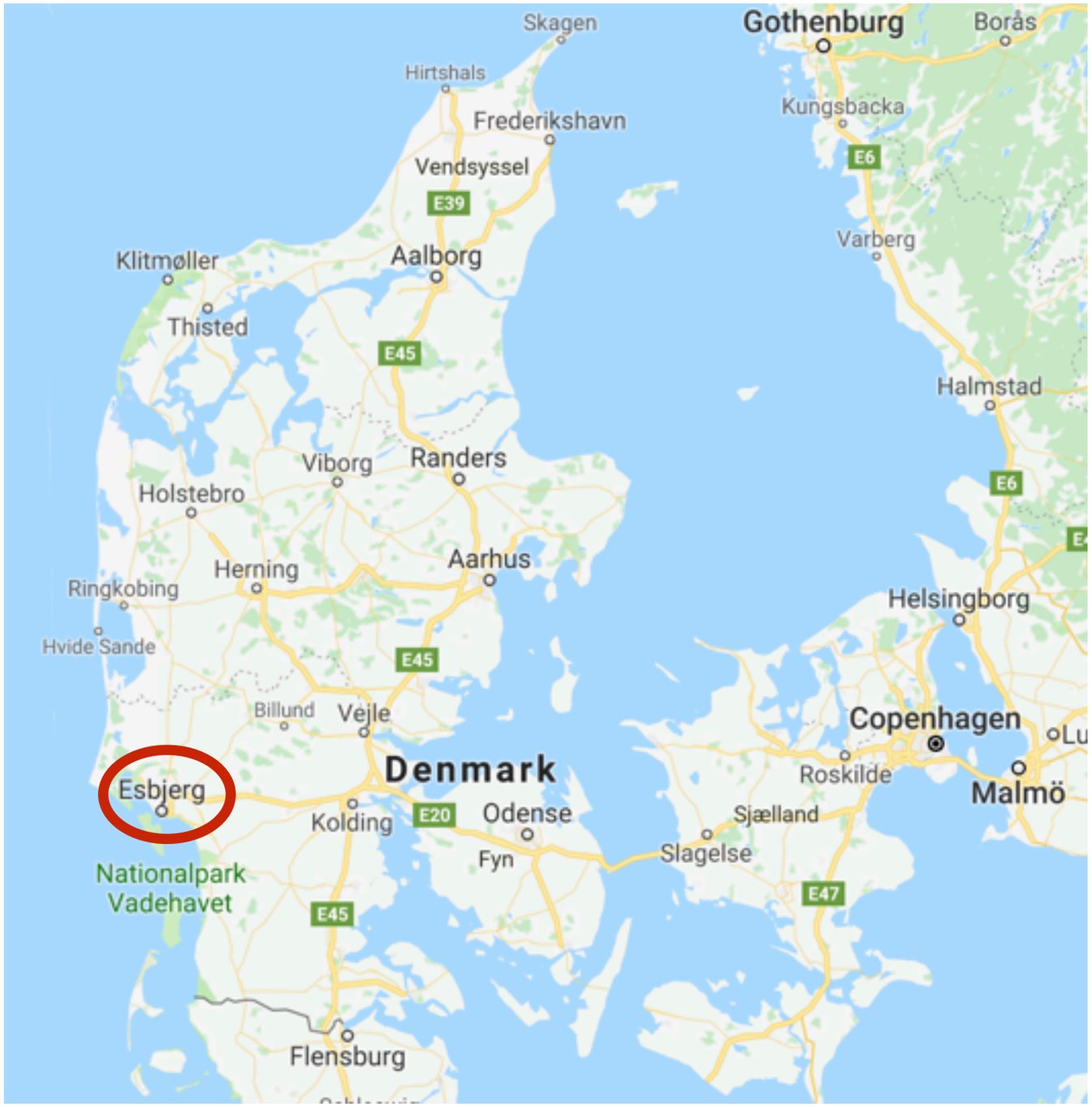
Developing Apache Camel microservices on Kubernetes

Claus Ibsen

@davsclaus

Boston
February 2018

I'm from Denmark



Walking the city park

Meet Washington

And this "strange Camel"

Claus Ibsen

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davsclaus
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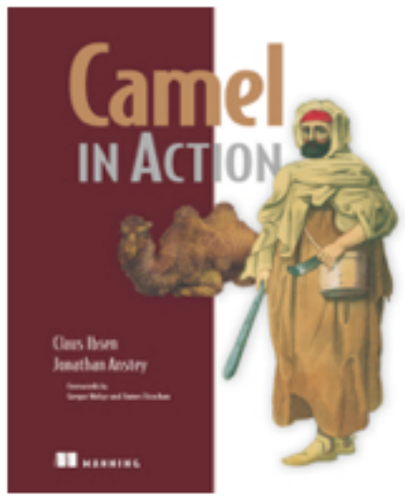
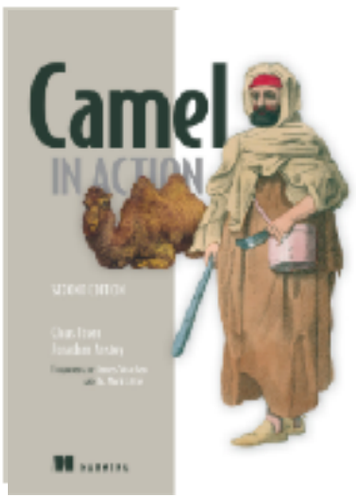
- Senior Principal Software Engineer at Red Hat

- Apache Camel
  9 years working with Camel

- Author of
  Camel in Action books

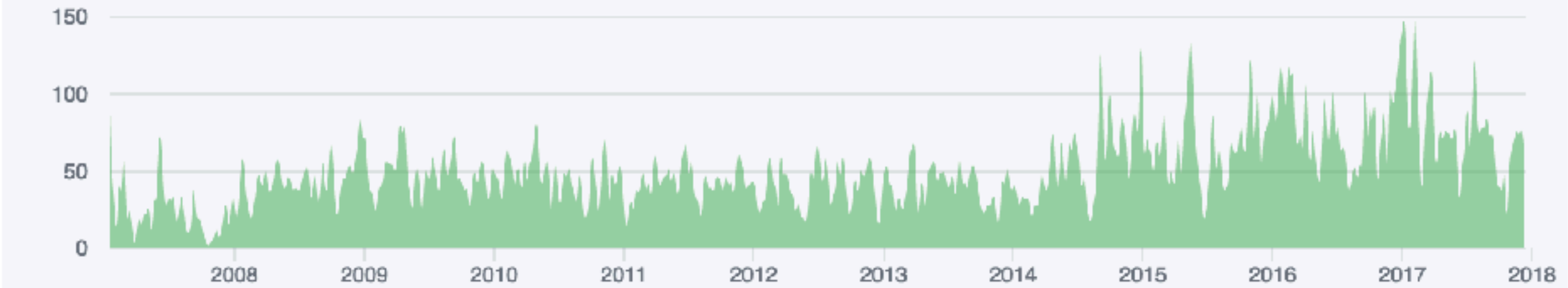




Mar 18, 2007 – Feb 15, 2018

Contributions: **Commits** ▾

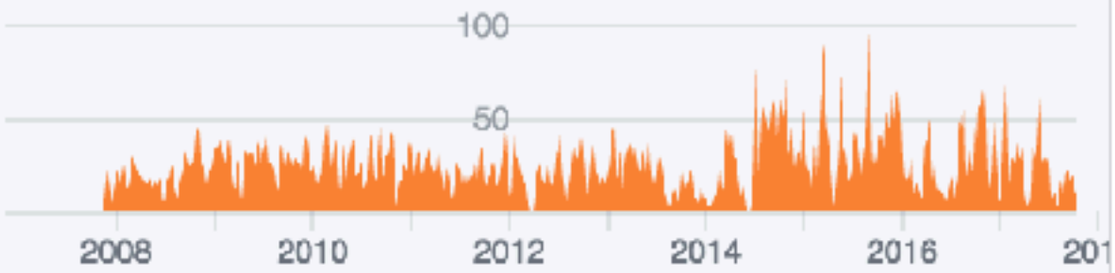
Contributions to master, excluding merge commits



davsclaus

#1

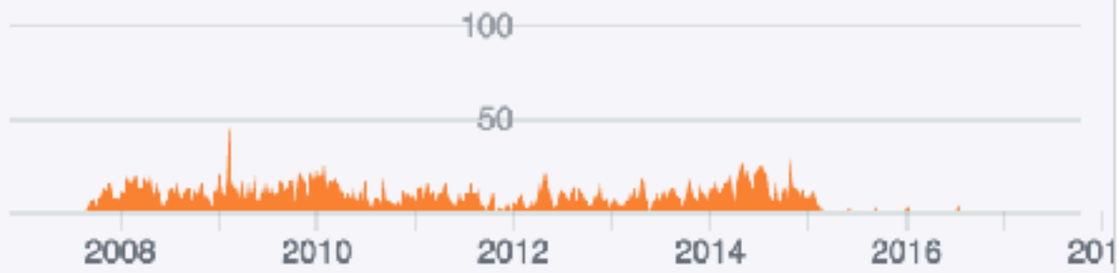
13,372 commits 1,607,528 ++ 980,591 --



WillemJiang

#2

4,075 commits 389,336 ++ 132,557 --



THE THREE PILLARS OF AGILE INTEGRATION

Key foundational capabilities needed by today's enterprises

DISTRIBUTED INTEGRATION

-LIGHTWEIGHT
-PATTERN BASED
-EVENT ORIENTED
-COMMUNITY SOURCED

FLEXIBILITY

CONTAINERS

- CLOUD NATIVE SOLUTIONS
-LEARN ARTIFACTS, INDIVIDUALLY DEPLOYABLE
- CONTAINER BASED SCALING AND HIGH AVAILABILITY

SCALABILITY

APIs

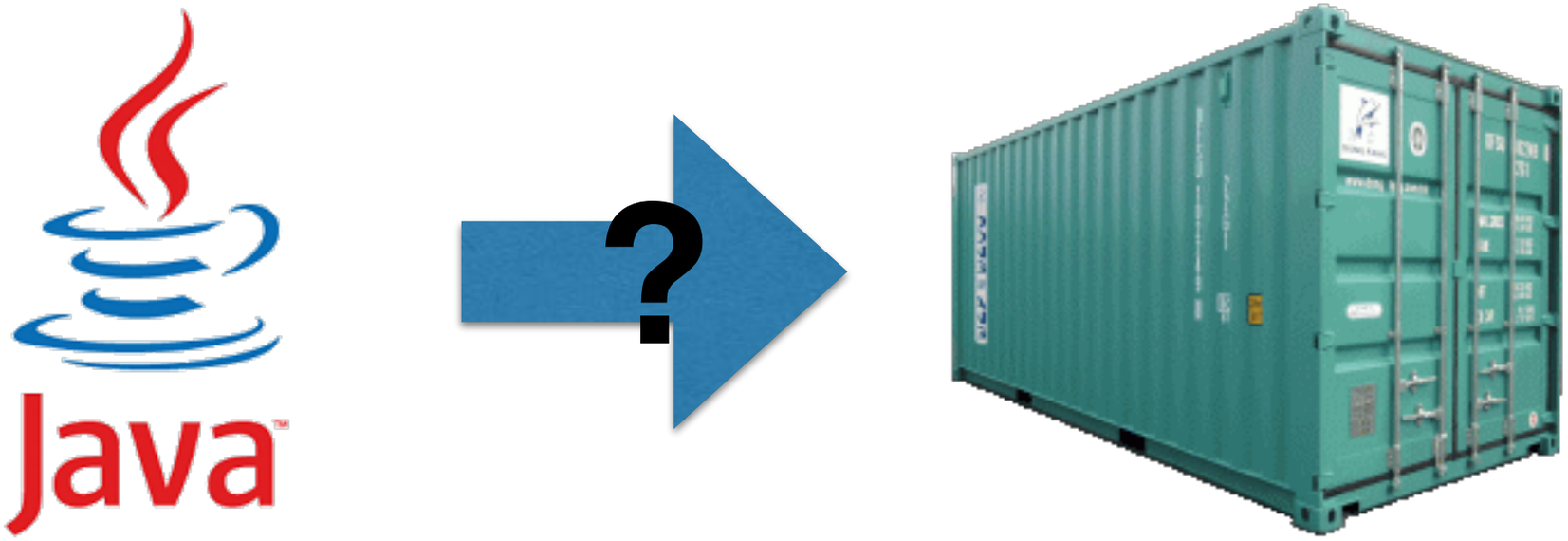
-WELL DEFINED, REUSABLE, AND WELL MANAGED END-POINTS
-ECOSYSTEM LEVERAGE

RE-USABILITY

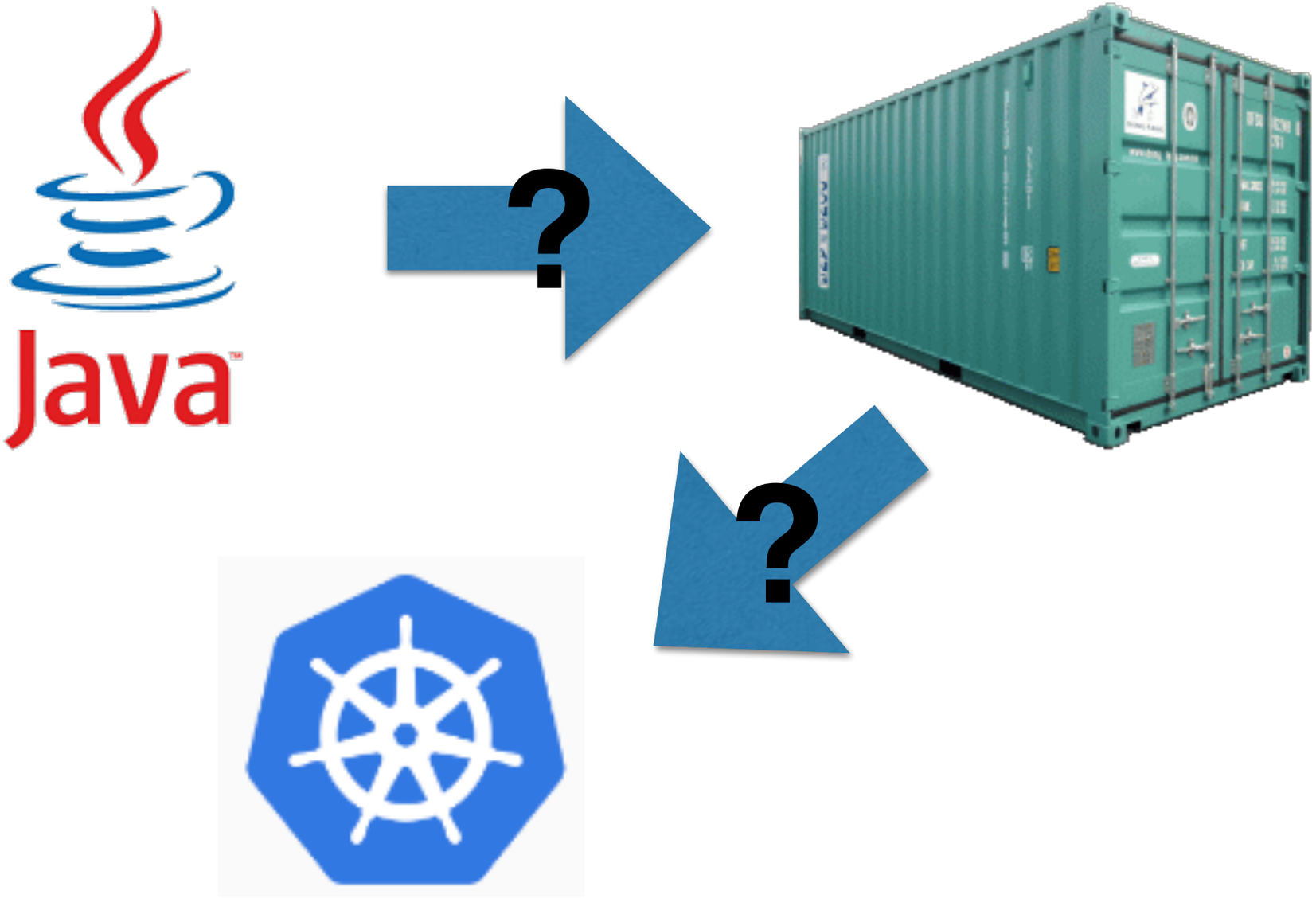
First steps

First steps

First steps



First steps



Tip of Iceberg

Running Kubernetes

Big "scary" cluster software

Running Local Kubernetes

Minishift

Running Local Kubernetes

Installing Minishift

1. Download Minishift

   https://github.com/minishift/minishift

2. Start Minishift

   ```
   $ minishift start
   ```

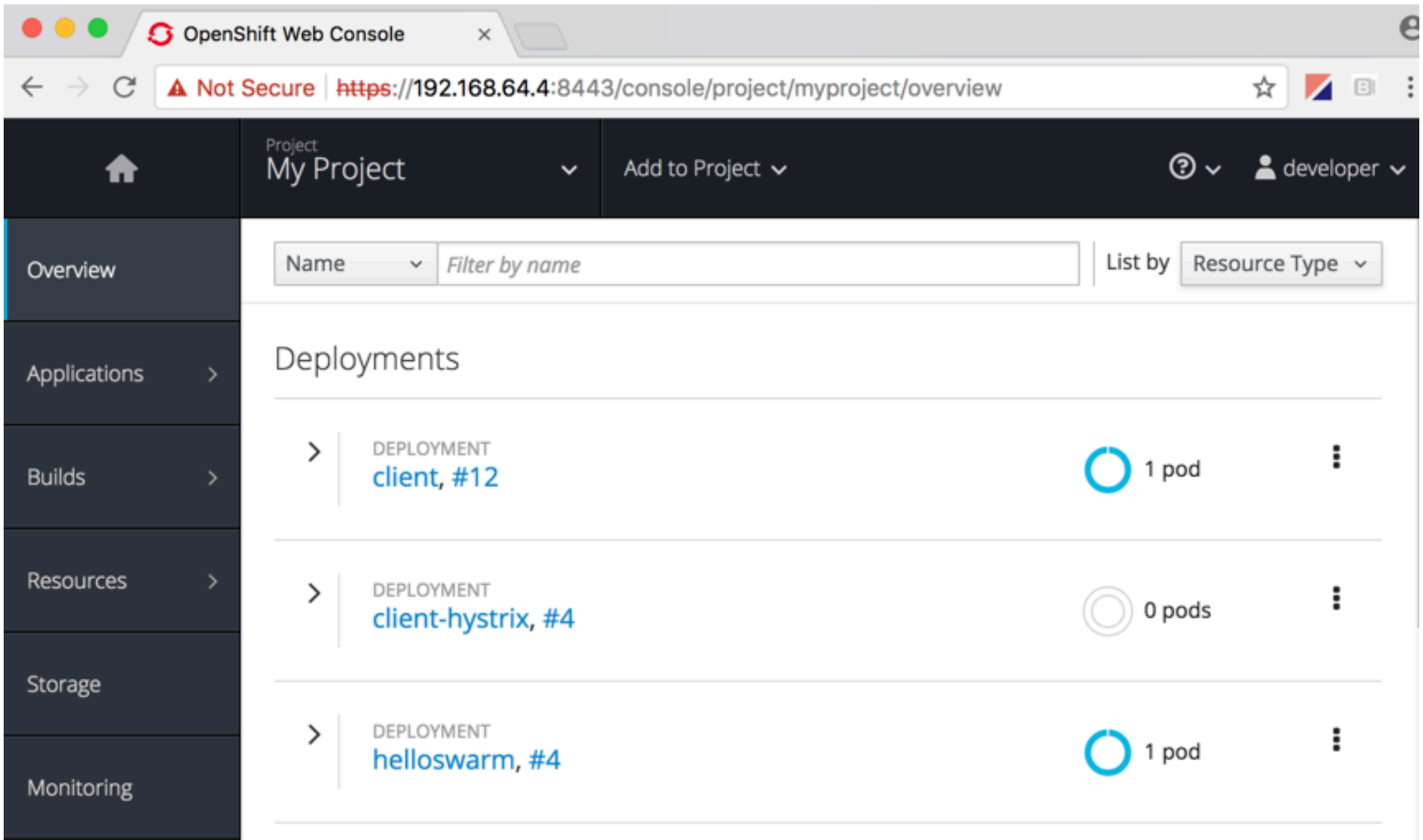
https://docs.openshift.org/latest/minishift/getting-started

How I installed Minishift

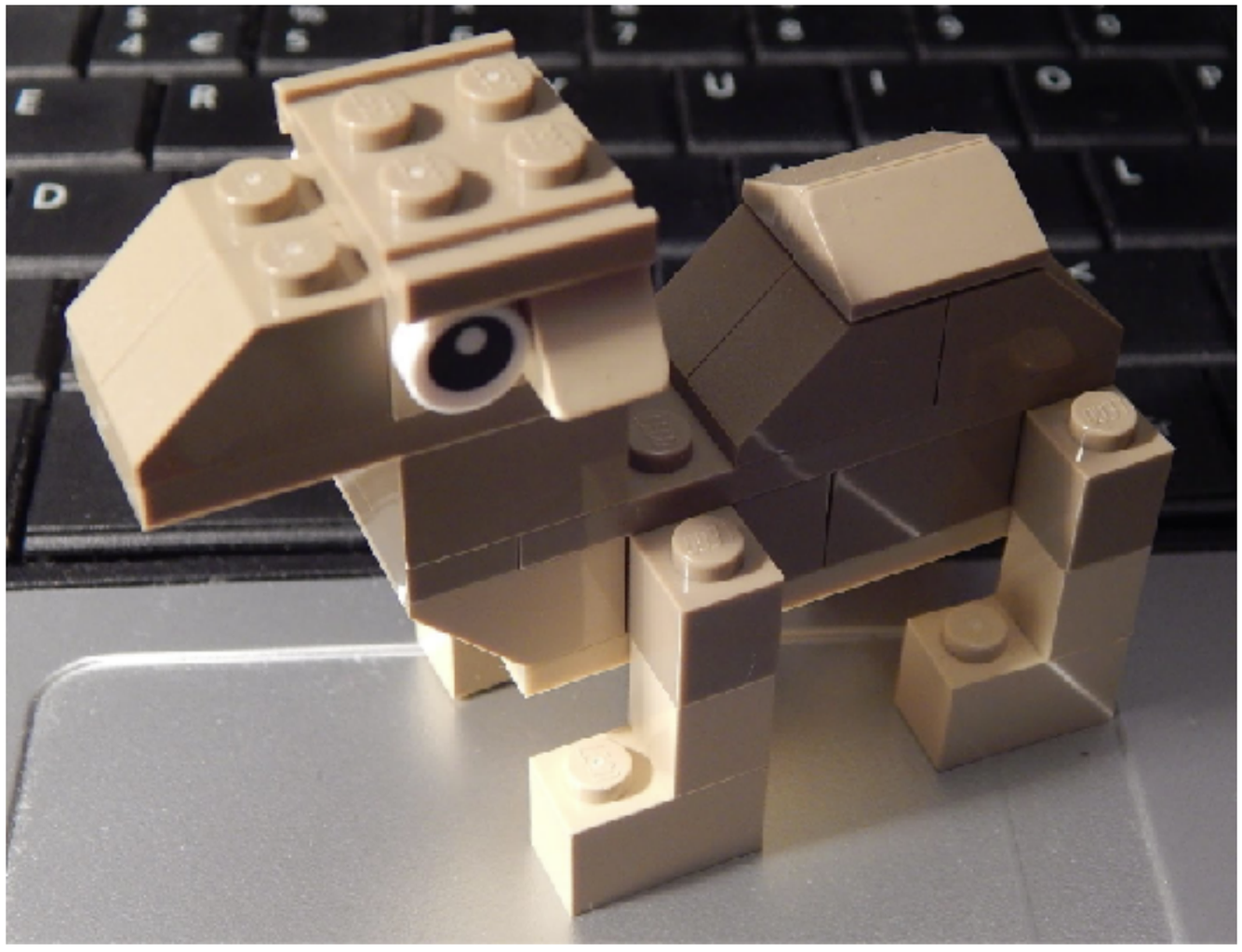
```
davsclaus:/Users/davsclaus/$ minishift start
Starting local OpenShift cluster using 'xhyve' hypervisor...
Downloading ISO 'https://github.com/minishift/minishift-b2d-iso
 40.00 MB / 40.00 MB [==========================================
Downloading OpenShift binary 'oc' version 'v1.5.0'
 18.93 MB / 18.93 MB [==========================================
-- Checking OpenShift client ... OK
-- Checking Docker client ... OK
-- Checking Docker version ... OK
-- Checking for existing OpenShift container ... OK
-- Checking for openshift/origin:v1.5.0 image ...
   Pulling image openshift/origin:v1.5.0
   Pulled 0/3 layers, 3% complete
   Pulled 1/3 layers, 72% complete
   Pulled 2/3 layers, 99% complete
   Pulled 3/3 layers, 100% complete
   Extracting
   Image pull complete
```

Web Console

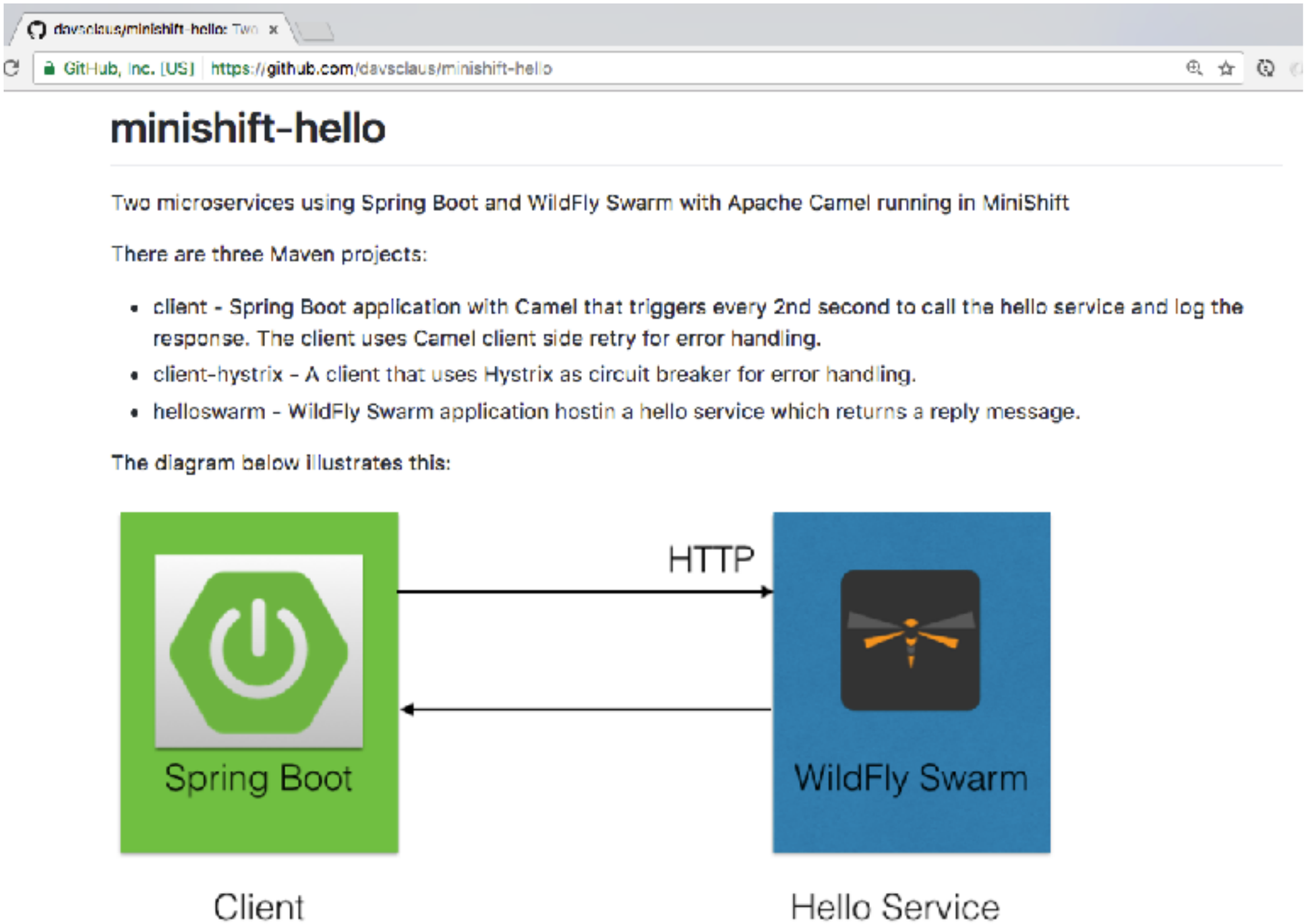
```
$ minishift console
```



Build a Camel Demo Time



Source Code & Slides



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

Hello Service

Client

Hello
Service

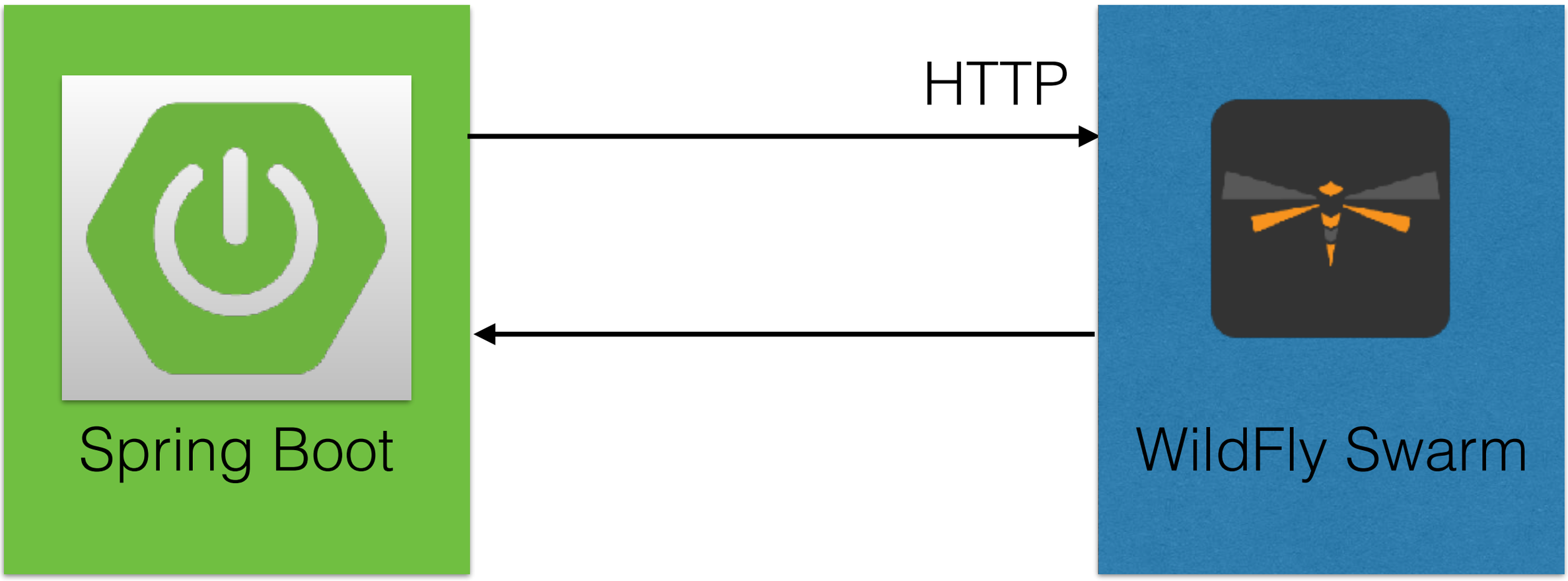
Hello Service

Swarm says hello from $HOSTNAME

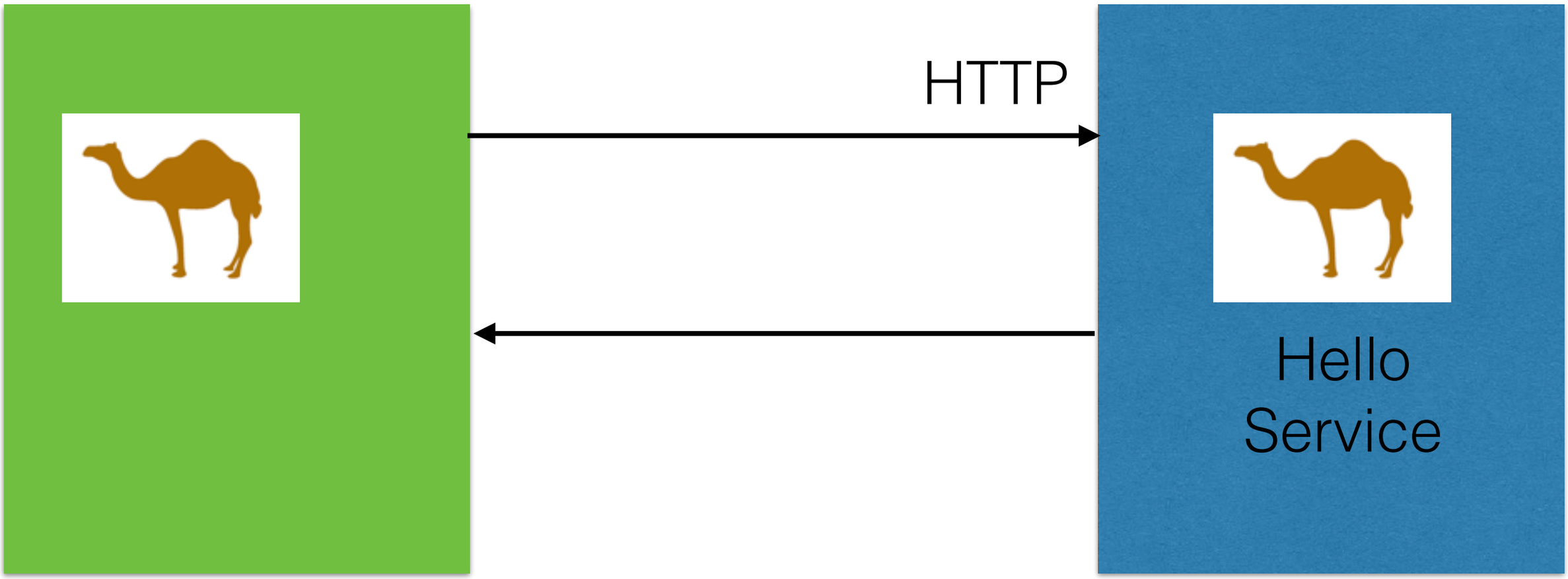
Client

Hello Service

Implementation



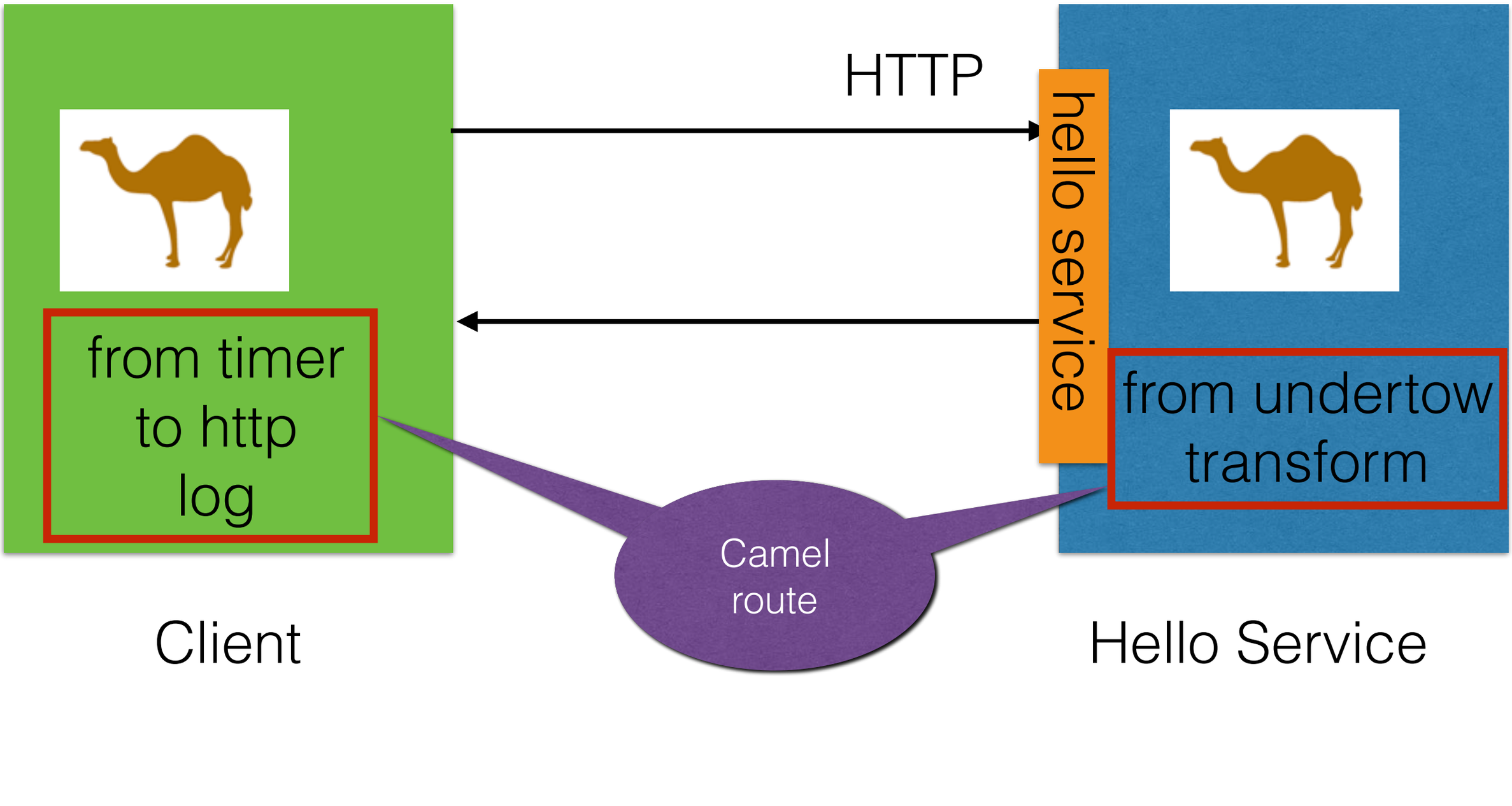
Implementation



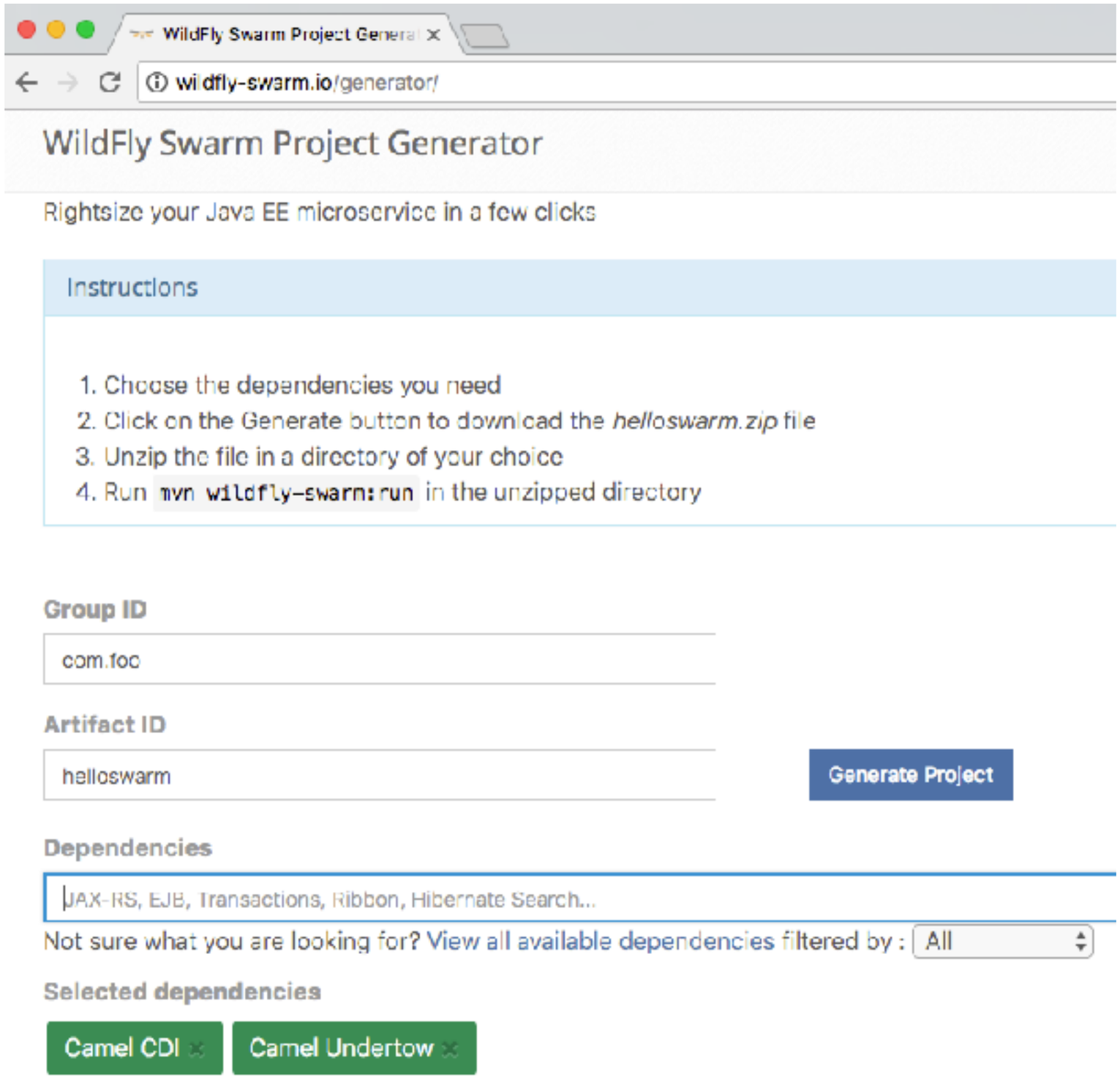
Client

Hello Service

Implementation



WildFly Swarm Generator



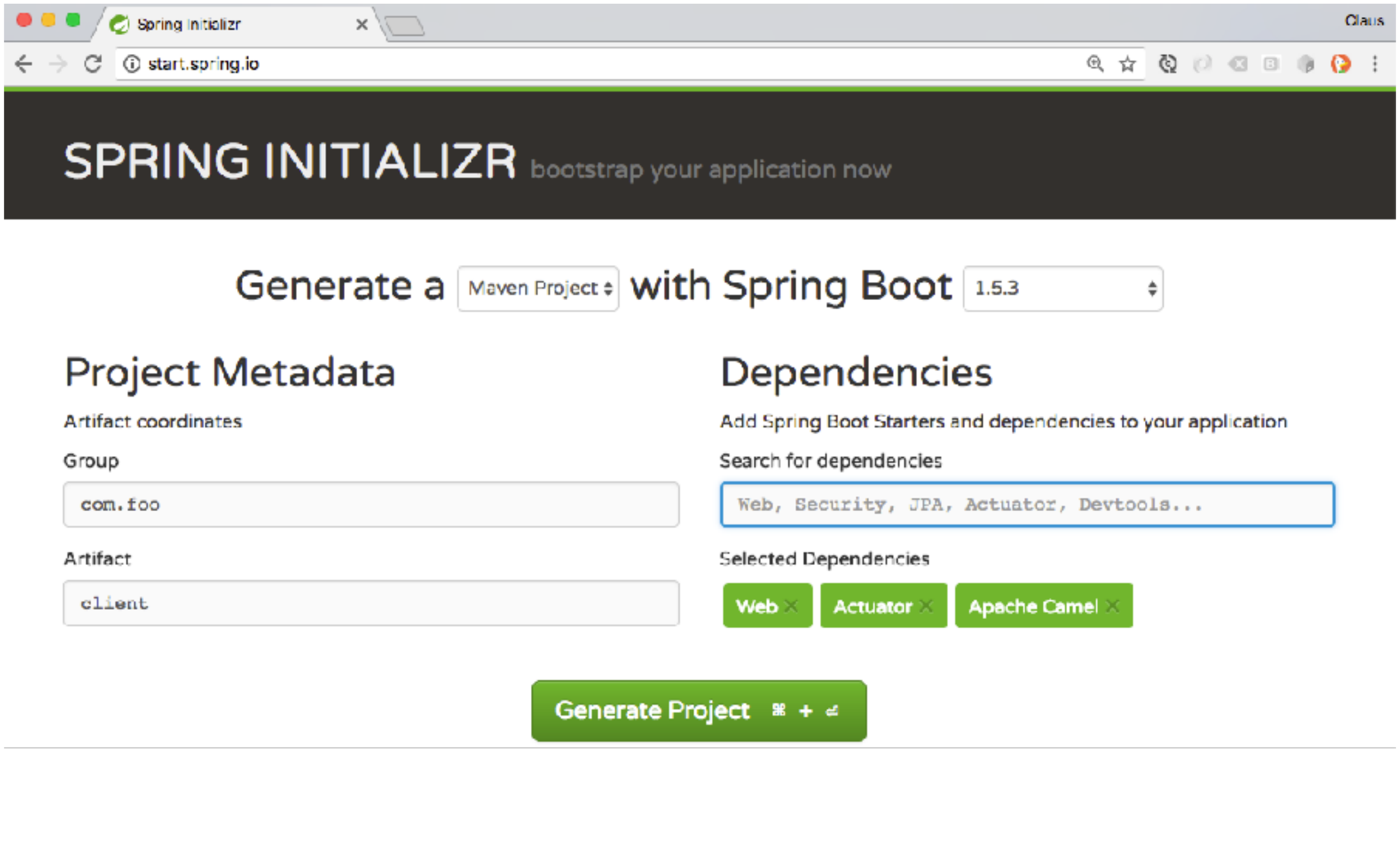
Hello Service

```
@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 {
        String answer = "Swarm says hello from "
            + InetAddressUtil.getLocalHostName();
        return answer;
    }
}
```

Spring Boot Starter



Client

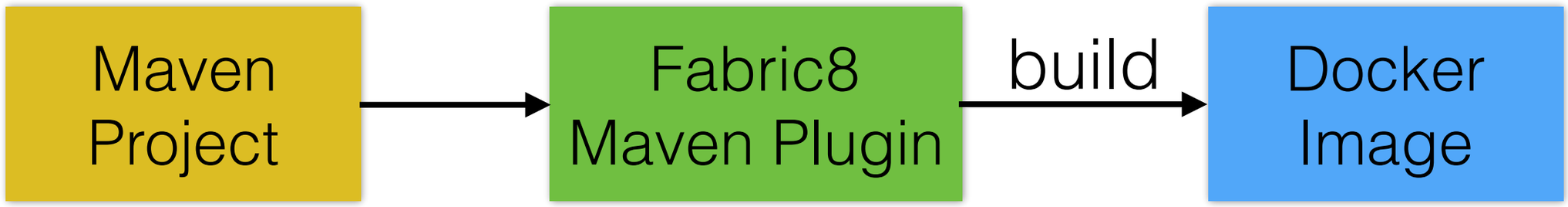
```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from( uri: "timer:foo?period=2000")
                .to("http4:localhost:8080/hello")
                .log("${body}");
    }
}
```

How to build Docker Image?

Maven Project

Docker Image

Fabric8 Maven Plugin



https://maven.fabric8.io

Fabric8 Maven Plugin


```xml
<plugin>
    <groupId>io.fabric8</groupId>
    <artifactId>fabric8-maven-plugin</artifactId>
    <version>3.5.33</version>
</plugin>
```

https://maven.fabric8.io

Setup Shell

- Prepare command shell

```
$ minikube docker-env
eval $(minikube docker-env)
```

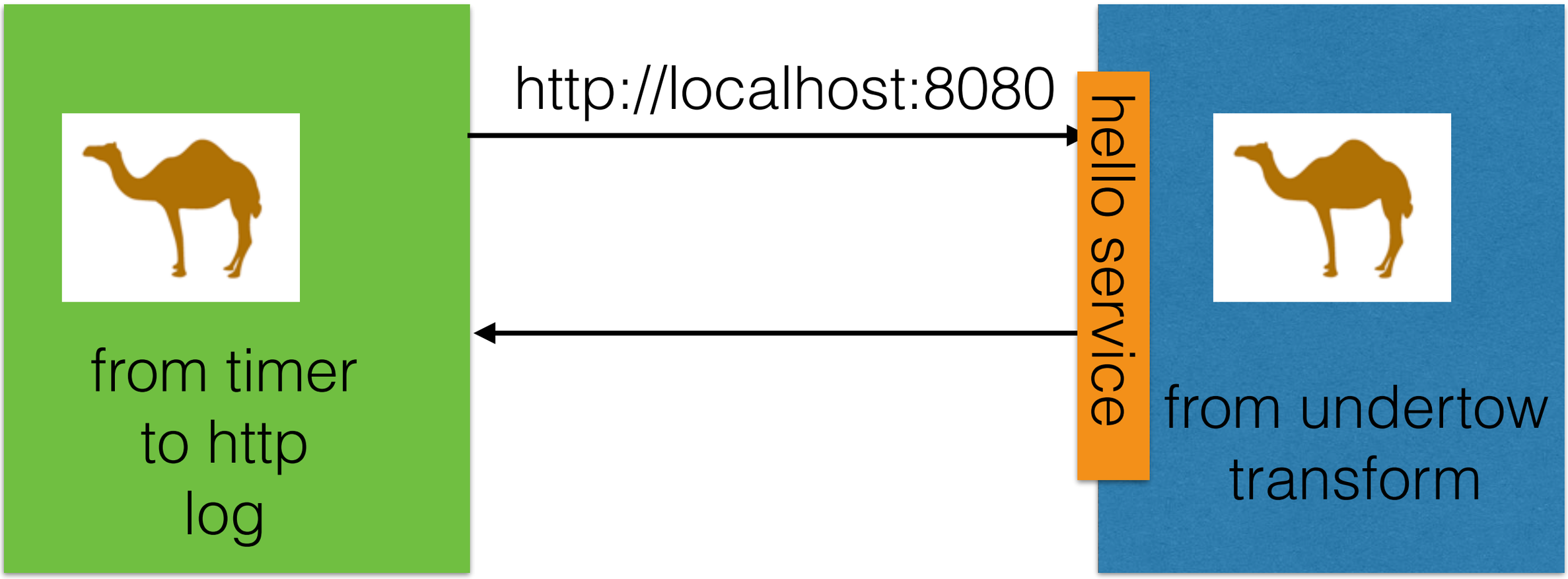
```
davsclaus:/Users/davsclaus/webinar/helloswarm (master)/$ minikube docker-env
export DOCKER_TLS_VERIFY="1"
export DOCKER_HOST="tcp://192.168.64.5:2376"
export DOCKER_CERT_PATH="/Users/davsclaus/.minikube/certs"
export DOCKER_API_VERSION="1.23"
# Run this command to configure your shell:
# eval $(minikube docker-env)
davsclaus:/Users/davsclaus/webinar/helloswarm (master)/$ eval $(minikube docker-env)
```

Build Docker Image

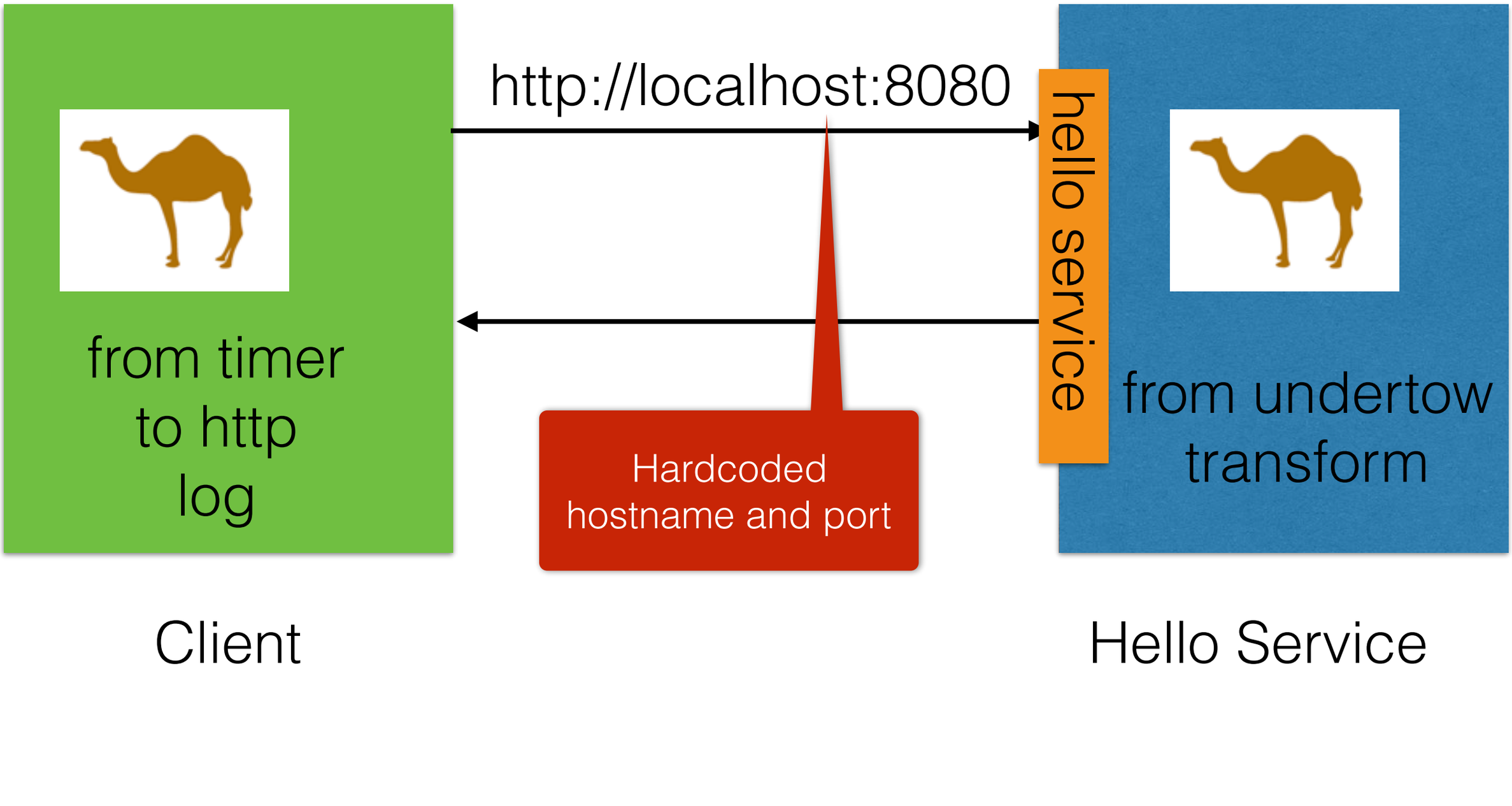
```
[INFO] --- fabric8-maven-plugin:3.3.5:resource (fmp) @ helloswarm ---
[INFO] F8: Running in Kubernetes mode
[INFO] F8: Running generator wildfly-swarm
[INFO] F8: wildfly-swarm: Using Docker image fabric8/java-jboss-openjdk8-jdk:1.2 as base / builder
[INFO] F8: fmp-controller: Adding a default Deployment
[WARNING] F8: fmp-service: Implicit service port mapping to port 80 has been disabled for the used
either use set the config port = 80 or use legacyPortMapping = true. See https://maven.fabric8.io/#
[INFO] F8: fmp-service: Adding a default service 'helloswarm' with ports [8080]
[INFO]
[INFO] --- maven-compiler-plugin:3.1:compile (default-compile) @ helloswarm ---
[INFO] Changes detected - recompiling the module!
[INFO] Compiling 2 source files to /Users/davsclaus/Documents/workspace/minishift-hello/helloswarm/
[INFO]
[INFO] --- maven-resources-plugin:2.6:testResources (default-testResources) @ helloswarm ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /Users/davsclaus/Documents/workspace/minishift-hello/hel
[INFO]
[INFO] --- maven-compiler-plugin:3.1:testCompile (default-testCompile) @ helloswarm ---
[INFO] No sources to compile
```

mvn fabric8:build

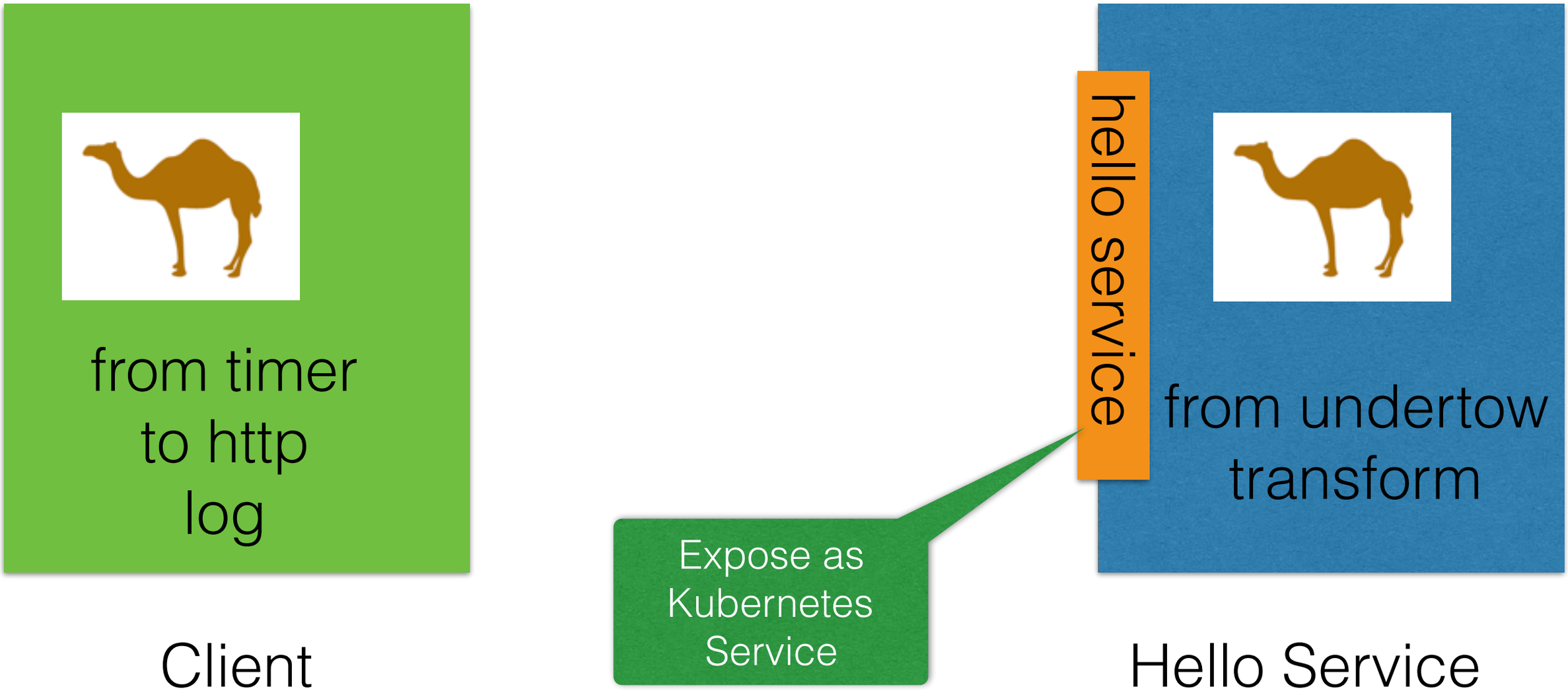
Our Demo


http://localhost:8080
hello service
from timer
to http
log
from undertow
transform
Client
Hello Service

Static vs Dynamic Platform



Dynamic Platform



Client

Hello Service

Dynamic Platform

Client

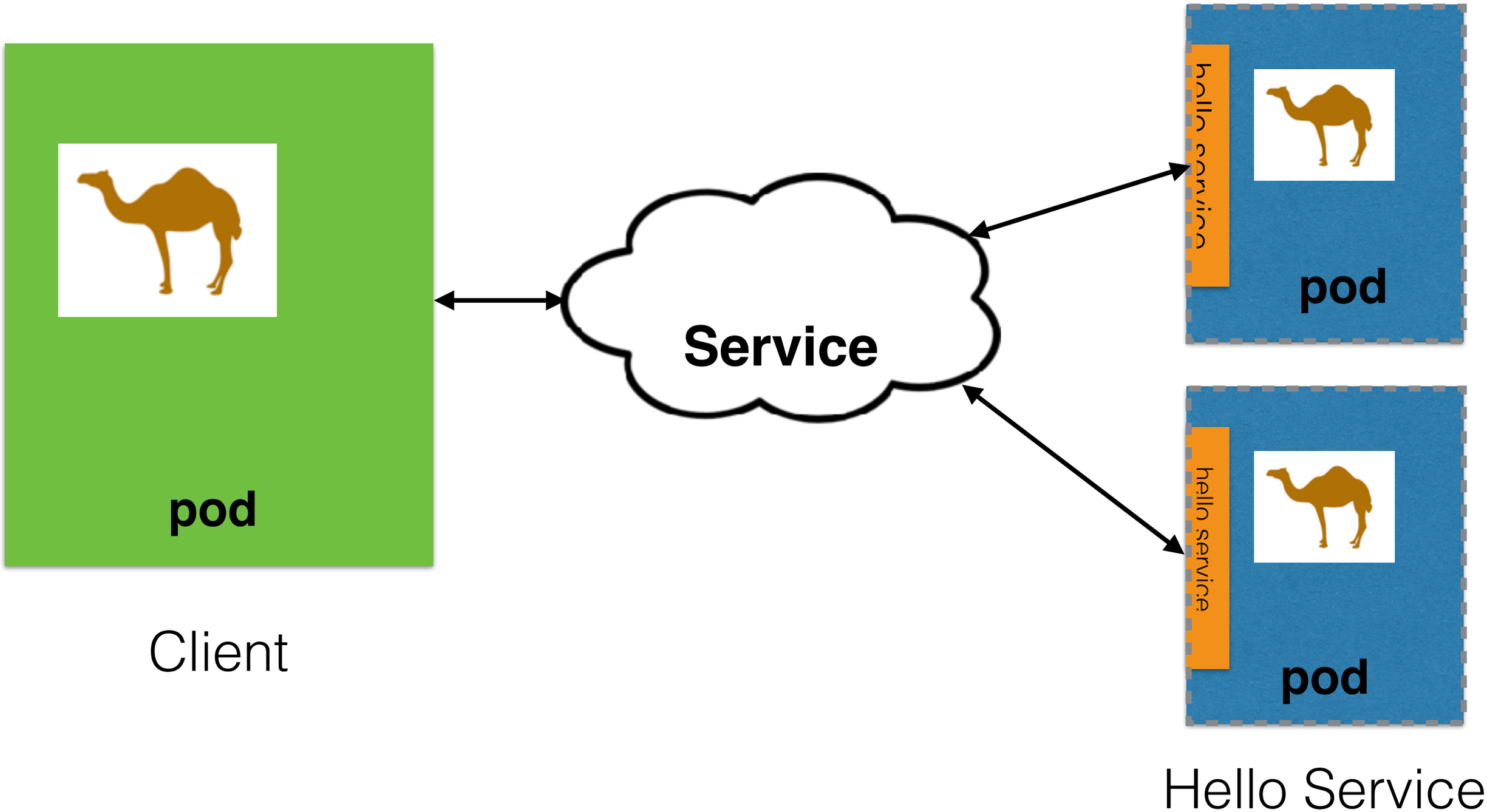
Hello Service

Dynamic Platform

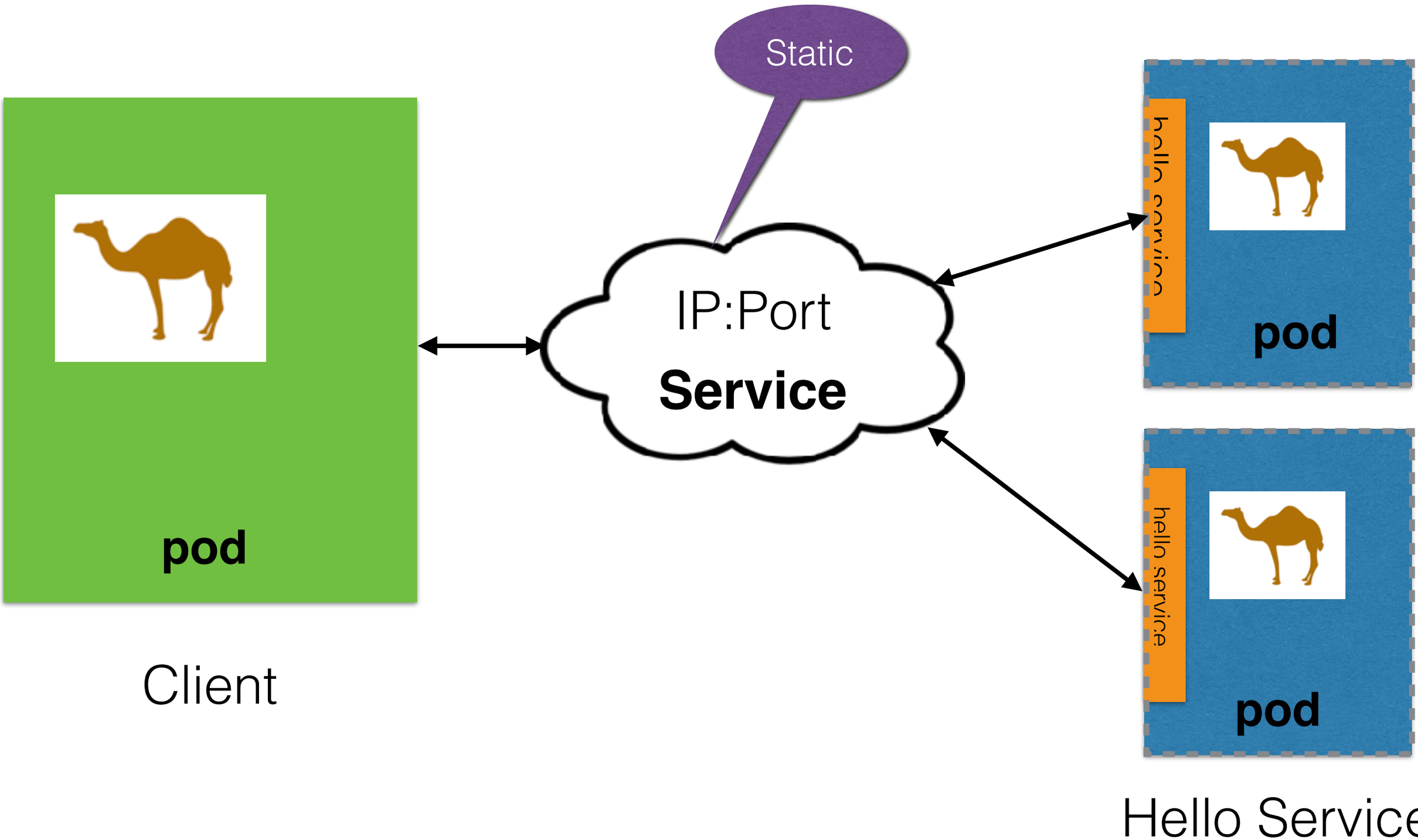
Client

Hello Service

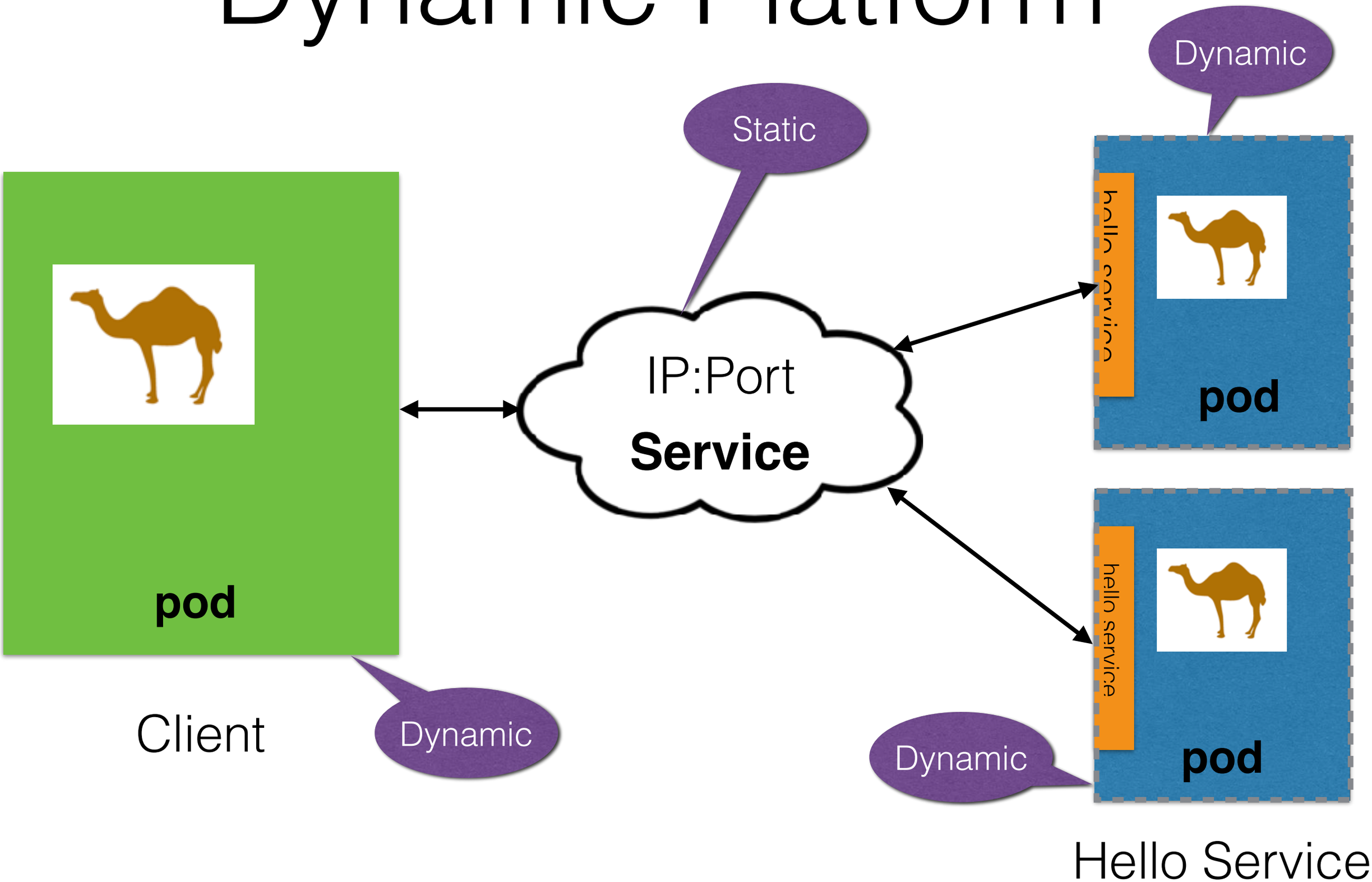
Dynamic Platform



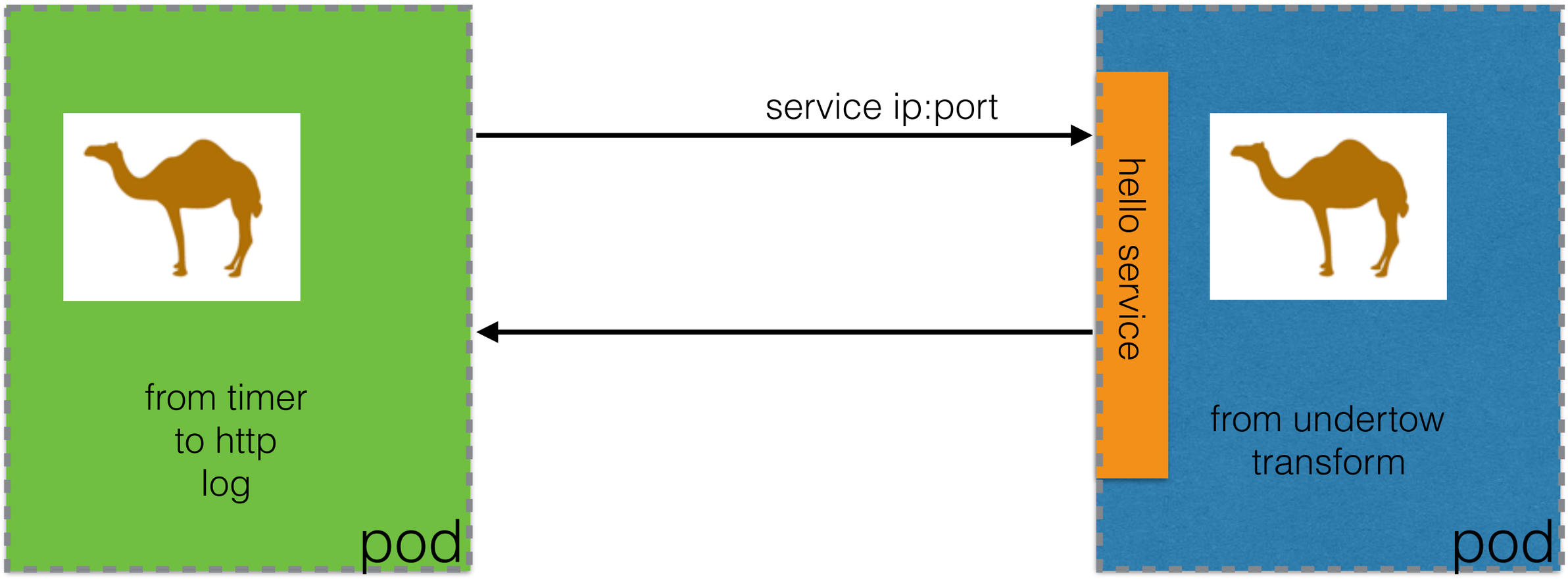
Dynamic Platform



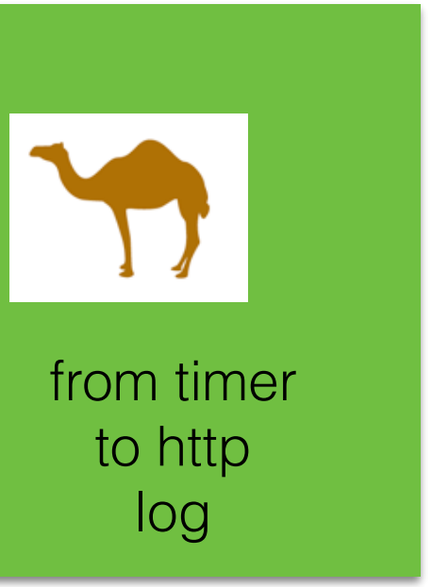
Dynamic Platform



Kubernetes Service from user point of view



Using Kubernetes Service



Client

We want to use hello service

How do we do that?

Using Kubernetes Service

- Environment Variables
  - Hostname
  - Port

```
export HELLOSWARM_SERVICE_HOST="172.30.237.105"
export HELLOSWARM_SERVICE_PORT="8080"
```

Service Discovery using DNS is also available

Service using ENV

- {{service:name}}

Client

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from( uri: "timer:too?period=2000")
                .to("http4:{{service:helloswarm}}/hello")
                .log("${body}");
    }
}
```

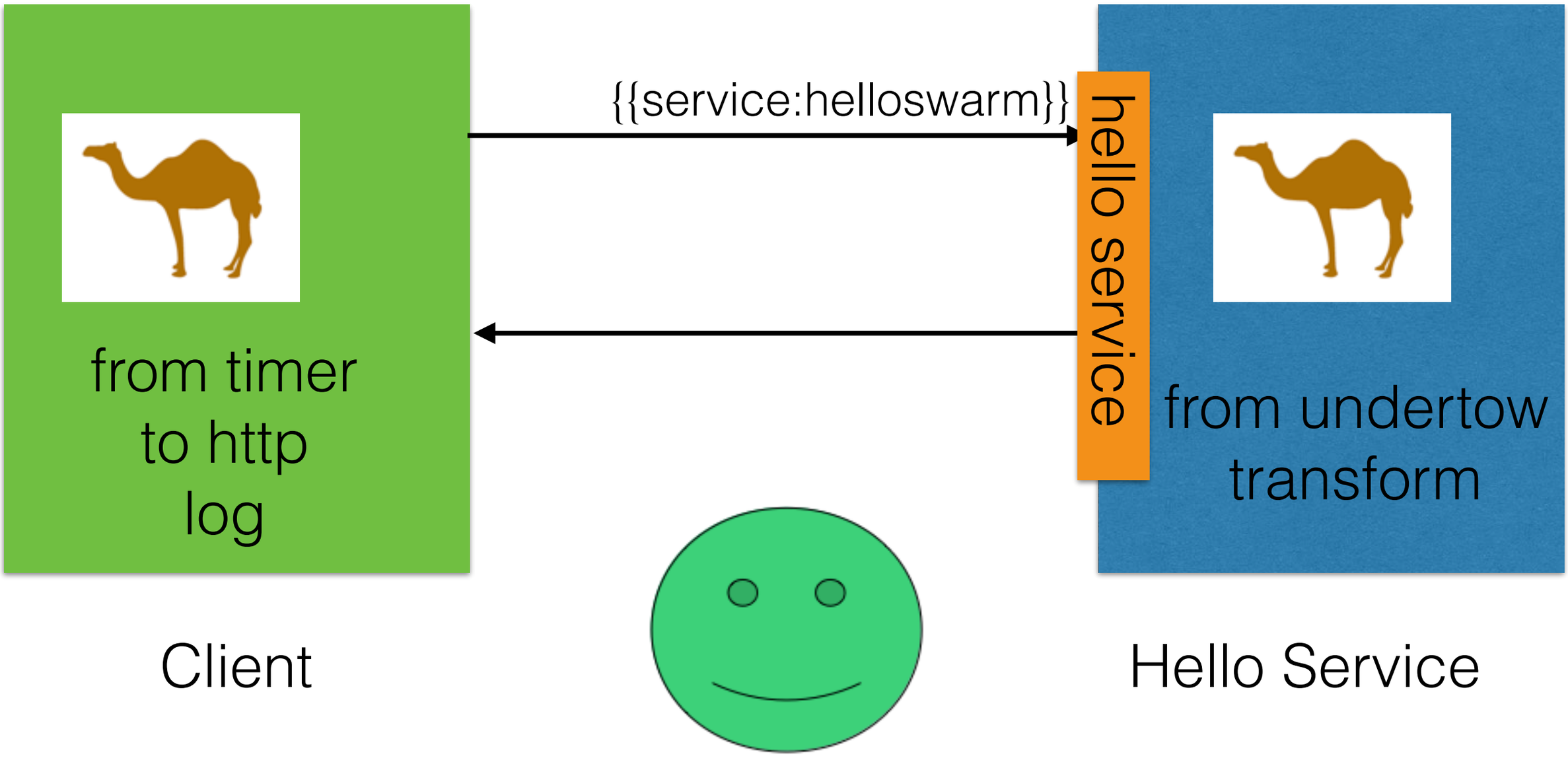
Service using DNS

Client

- servicename:port

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from( uri: "timer:too?period=2000")
                .to("http4:helloswarm:8080/hello")
                .log("${body}");
    }
}
```

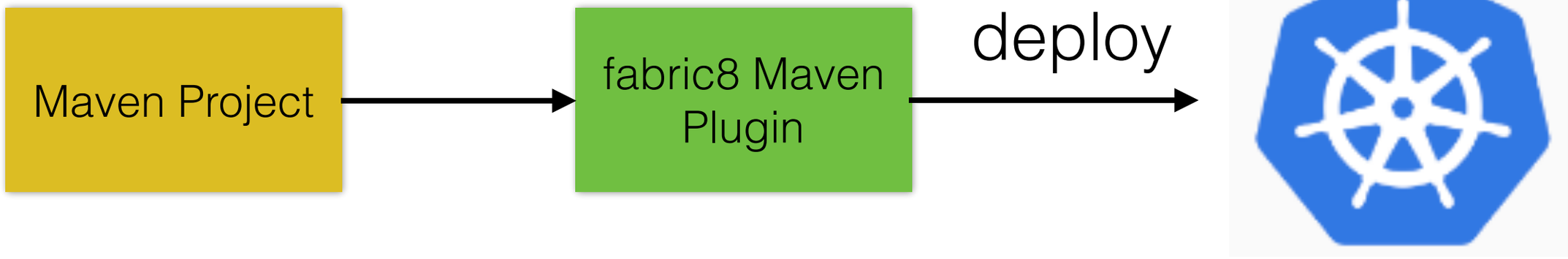
Ready to run in Kubernetes



How to deploy to Kubernetes?

Maven Project

How to deploy to Kubernetes?



Deploy - Hello Service

- `$ mvn fabric8:deploy`

Hello Service

```
[INFO] --- fabric8-maven-plugin:3.3.5:resource (fmp) @ helloswarm ---
[INFO] F8: Running in Kubernetes mode
[INFO] F8: Running generator wildfly-swarm
[INFO] F8: wildfly-swarm: Using Docker image fabric8/java-jboss-openjdk8-jdk:1.2 as base / builder
[INFO] F8: fmp-controller: Adding a default Deployment
[WARNING] F8: fmp-service: Implicit service port mapping to port 80 has been disabled for the used
either use set the config port = 80 or use legacyPortMapping = true. See https://maven.fabric8.io/#
[INFO] F8: fmp-service: Adding a default service 'helloswarm' with ports [8080]
[INFO]
[INFO] --- maven-compiler-plugin:3.1:compile (default-compile) @ helloswarm ---
[INFO] Changes detected - recompiling the module!
[INFO] Compiling 2 source files to /Users/davsclaus/Documents/workspace/minishift-hello/helloswarm/
[INFO]
[INFO] --- maven-resources-plugin:2.6:testResources (default-testResources) @ helloswarm ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] skip non existing resourceDirectory /Users/davsclaus/Documents/workspace/minishift-hello/hel
[INFO]
[INFO] --- maven-compiler-plugin:3.1:testCompile (default-testCompile) @ helloswarm ---
[INFO] No sources to compile
```

Deploy - Client

from timer
to http
log

- `$ mvn fabric8:deploy`

Client

```
[INFO] >>> fabric8-maven-plugin:3.5.33:deploy (default-cli) > install @ client >>>
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @ client ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] Copying 1 resource
[INFO] Copying 0 resource
[INFO]
[INFO] --- fabric8-maven-plugin:3.5.33:resource (fmp) @ client ---
[INFO] F8: Running in Kubernetes mode
[INFO] F8: Running generator spring-boot
[INFO] F8: spring-boot: Using Docker image fabric8/java-jboss-openjdk8-jdk:1.2 as base / builder
[INFO] F8: fmp-controller: Adding a default Deployment
[INFO] F8: fmp-service: Adding a default service 'client' with ports [8080]
[INFO] F8: spring-boot-health-check: Adding readiness probe on port 8080, path='/health', scheme='
[INFO] F8: spring-boot-health-check: Adding liveness probe on port 8080, path='/health', scheme='H
[INFO] F8: fmp-revision-history: Adding revision history limit to 2
[INFO] F8: f8-icon: Adding icon for deployment
[INFO] F8: f8-icon: Adding icon for service
[INFO] F8: validating /Users/davsclaus/Documents/workspace/minishift-hello/client/target/classes/M
tconfig.yml resource
```

Run - Client

from timer
to http
log

Runs in foreground, tail log, undeploys when ctrl + c

- `$ mvn fabric8:run`

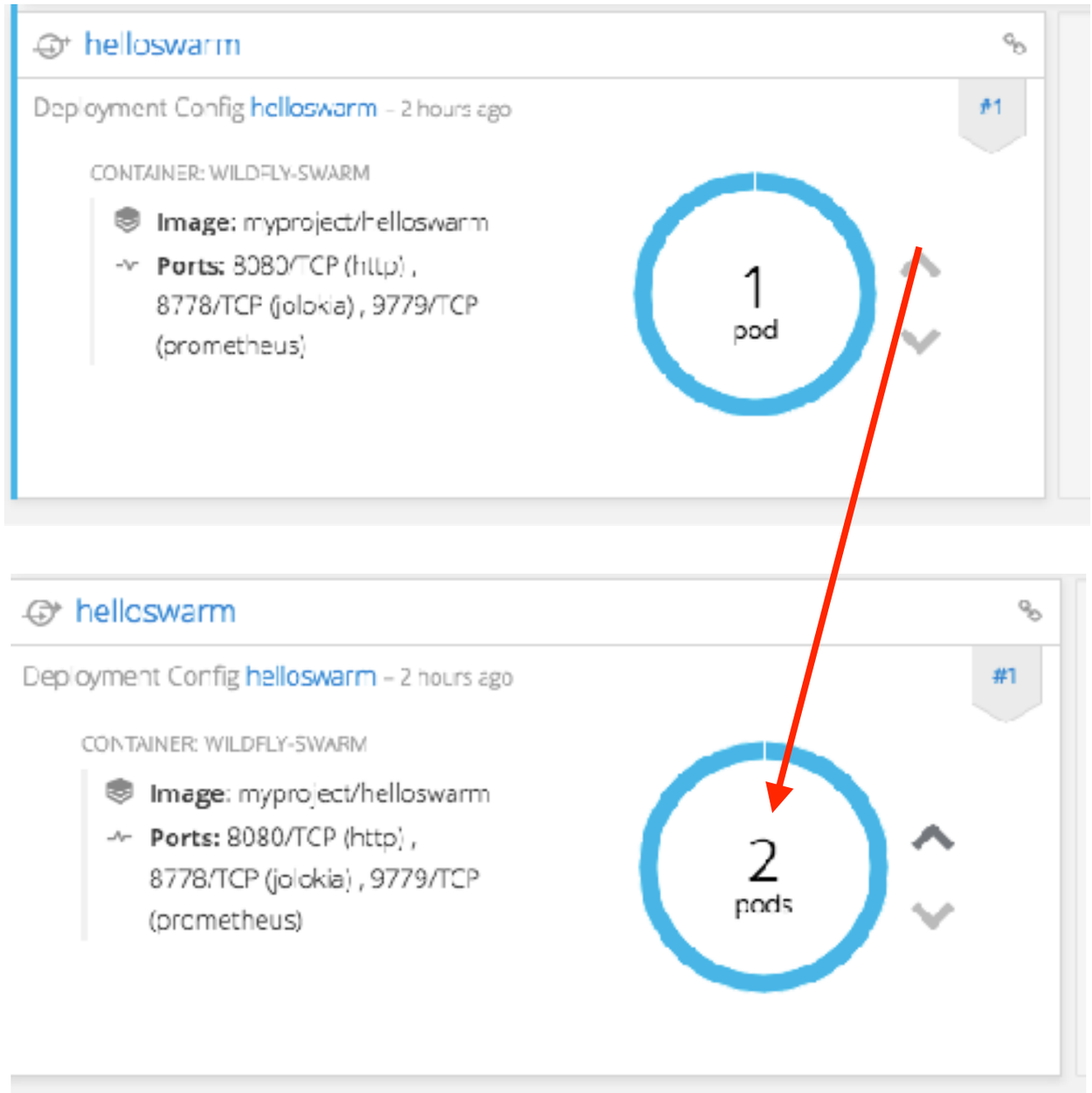
Client

```
[INFO] F8: Scaling Deployment default/client to replicas: 1
[INFO] F8: Watching pods with selector LabelSelector(matchExpressions=[], matchLabels={app=client, provider=fab
ric8, group=com.foo}, additionalProperties={}) waiting for a running pod...
[INFO] F8:[NEW] client-76cb7c865b-fh6tv status: Running
[INFO] F8:[NEW] Tailing log of pod: client-76cb7c865b-fh6tv
[INFO] F8:[NEW] Press Ctrl-C to scale down the app and stop tailing the log
[INFO] F8:[NEW]
[INFO] F8: exec java -javaagent:/opt/agent-bond/agent-bond.jar=jolokia{{host=0.0.0.0}},jmx_exporter{{9779:/opt/
agent-bond/jmx_exporter_config.yml}} -cp . -jar /deployments/client-1.0-SNAPSHOT.jar
[INFO] F8: I> No access restrictor found, access to any MBean is allowed
[INFO] F8: Jolokia: Agent started with URL http://172.17.0.4:8778/jolokia/
[INFO] F8: 2017-12-04 15:29:52.870:INFO:ifasjipjsoejs.Server:jetty-8.y.z-SNAPSHOT
[INFO] F8: 2017-12-04 15:29:52.909:INFO:ifasjipjsoejs.AbstractConnector:Started SelectChannelConnector@0.0.0.0:
9779
[INFO] F8:
[INFO] F8:   .   ____          _            __ _ _
[INFO] F8:  /\\ / ___'_ __ _ _(_)_ __  __ _ \ \ \ \
[INFO] F8: ( ( )\___ | '_ | '_| | '_ \/ _` | \ \ \ \
[INFO] F8:  \\/  ___)| |_)| | | | | || (_| |  ) ) ) )
[INFO] F8:   '  |____| .__|_| |_|_| |_\__, | / / / /
[INFO] F8:  =========|_|==============|___/=/_/_/_/
[INFO] F8:  :: Spring Boot ::        (v1.5.8.RELEASE)
[INFO] F8:
[INFO] F8: 2017-12-04 15:29:53.880  INFO 1 --- [           main] com.foo.DemoApplication                  : Sta
```

Ready to run in Kubernetes

Scaling

- Change deployment replicas



Scaling

- Service load balancing

Load balancing is random

```
: Swarm says hello from helloswarm-1-bjdbj
: Swarm says hello from helloswarm-1-bjdbj
: Swarm says hello from helloswarm-1-bjdbj
: Swarm says hello from helloswarm-1-bjdbj
: Swarm says hello from helloswarm-1-s5rfh
: Swarm says hello from helloswarm-1-s5rfh
: Swarm says hello from helloswarm-1-bjdbj
: Swarm says hello from helloswarm-1-bjdbj
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: Swarm says hello from helloswarm-1-s5rfh
: Swarm says hello from helloswarm-1-bjdbj
: Swarm says hello from helloswarm-1-s5rfh
: Swarm says hello from helloswarm-1-bjdbj
```
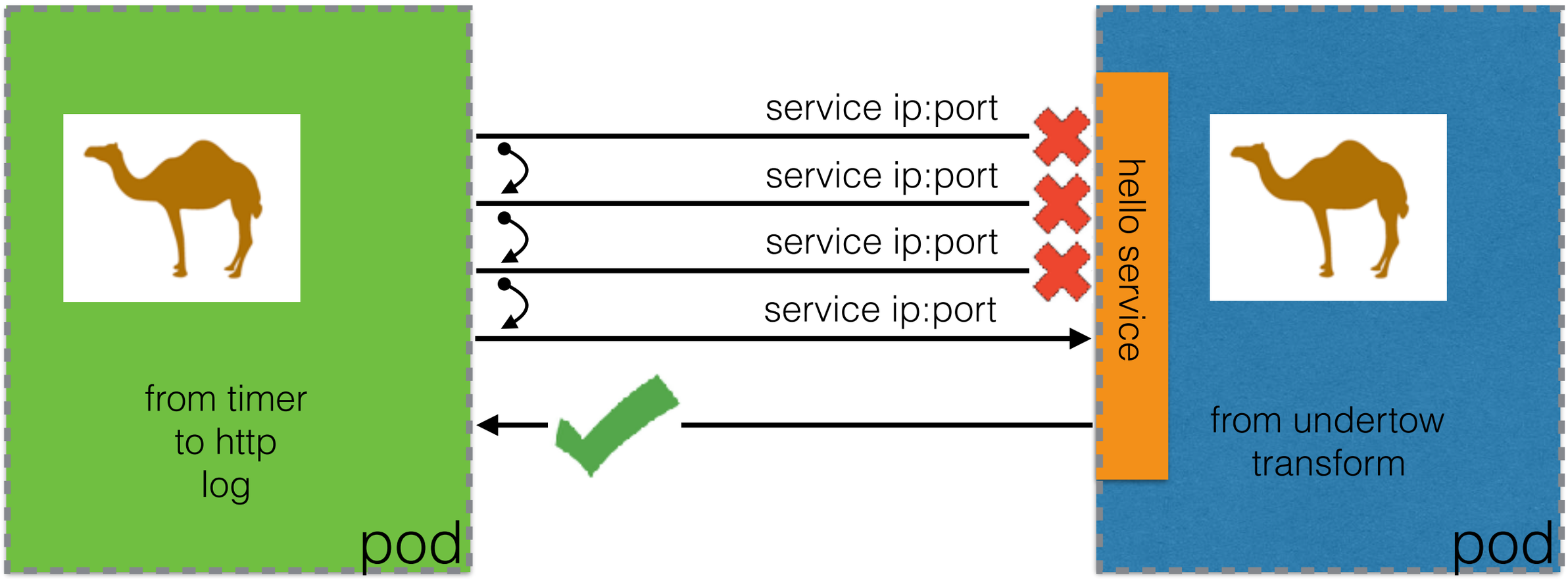

Error Handling

- Client Side Retry



Error Handling

- Client Side Retry

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        // try to call the service again
        onException(Exception.class)
                .maximumRedeliveries(10)
                .redeliveryDelay(1000);

        from( uri: "timer:foo?period=2000")
                .to("http4:{{service:helloswarm}}/hello")
                .log("${body}");
    }
}
```

Error Handling

- Client Side Retry

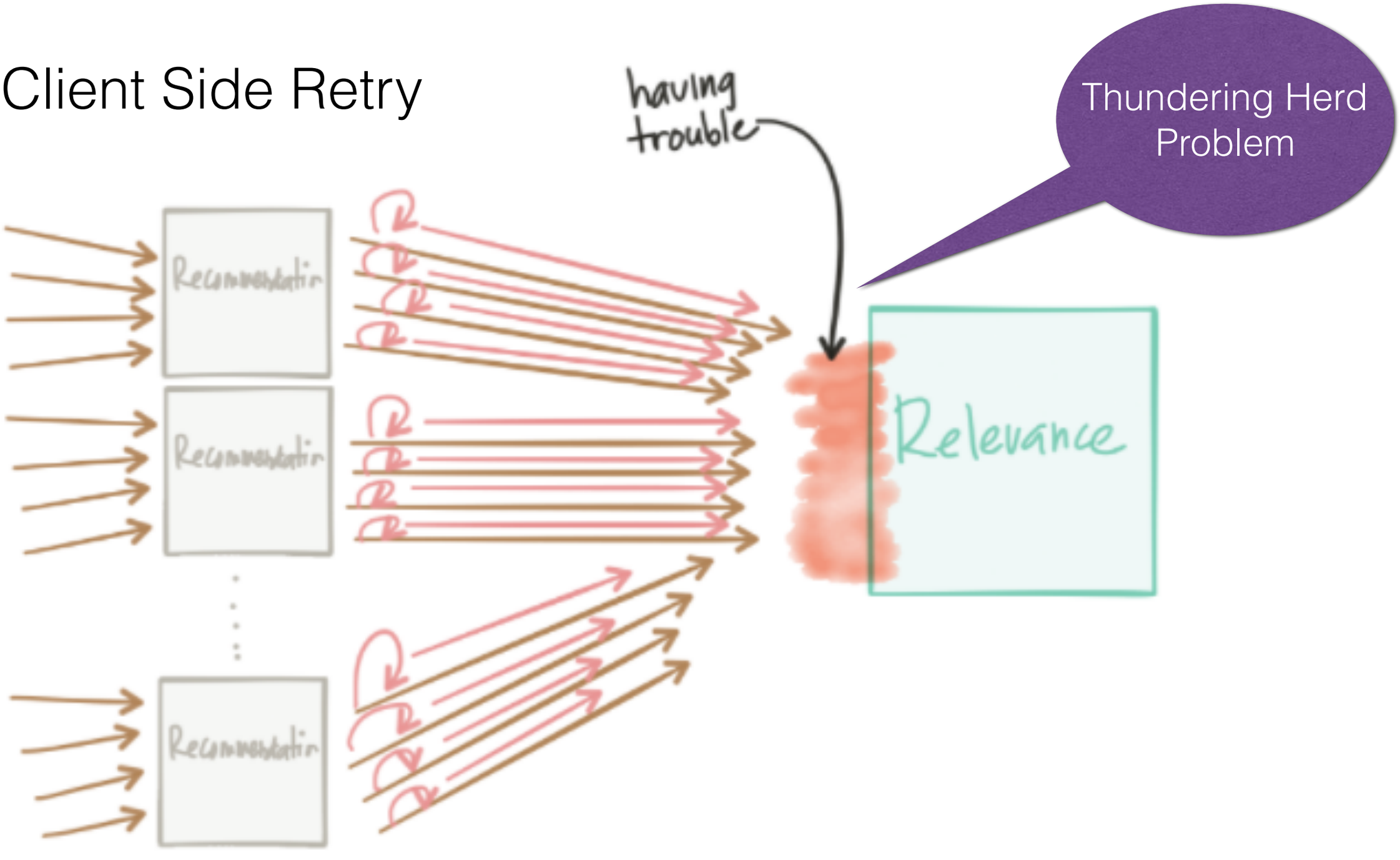
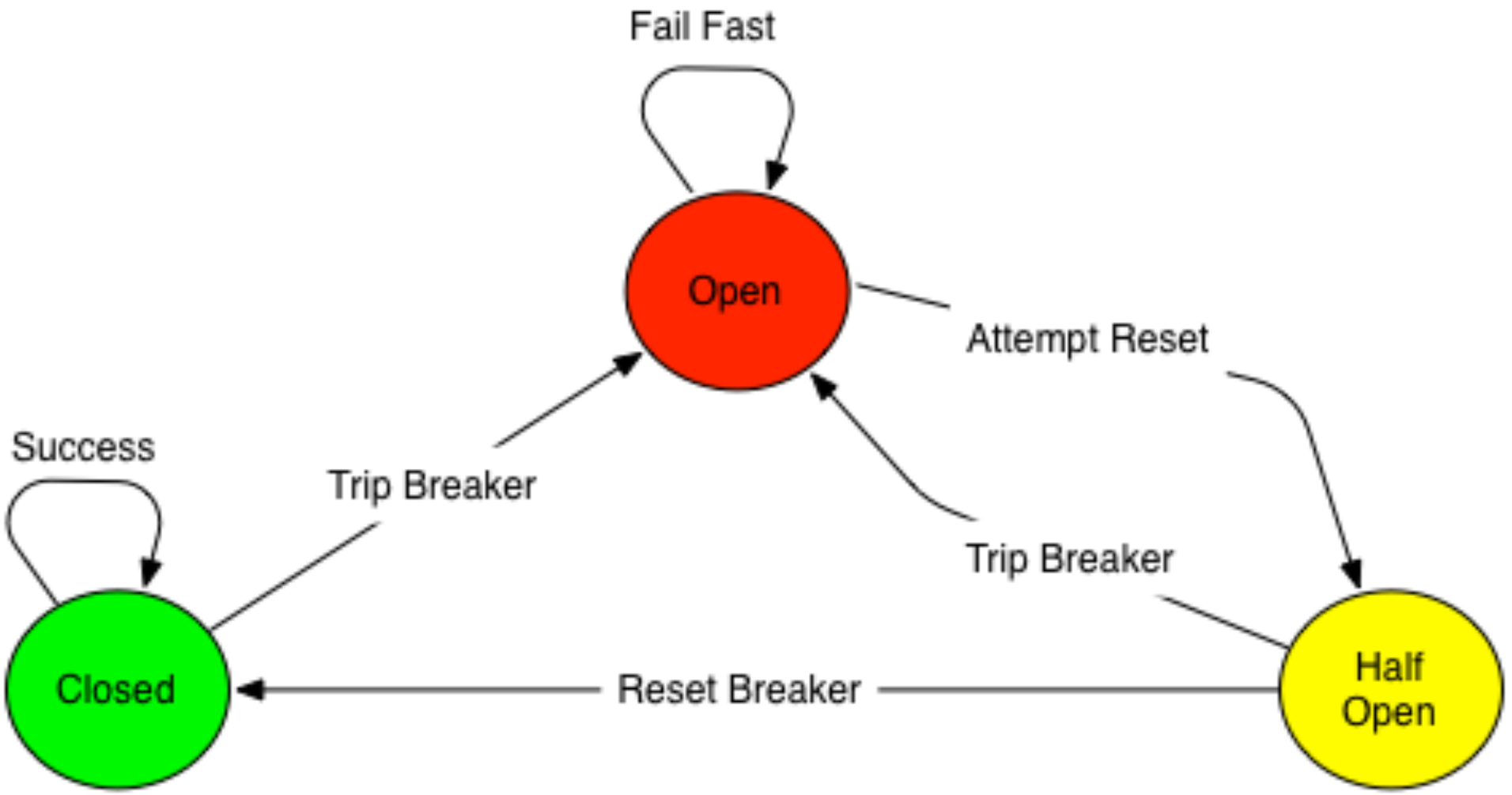


Figure by Christian Posta

Error Handling

- Client Side Circuit Breaker with Hystrix

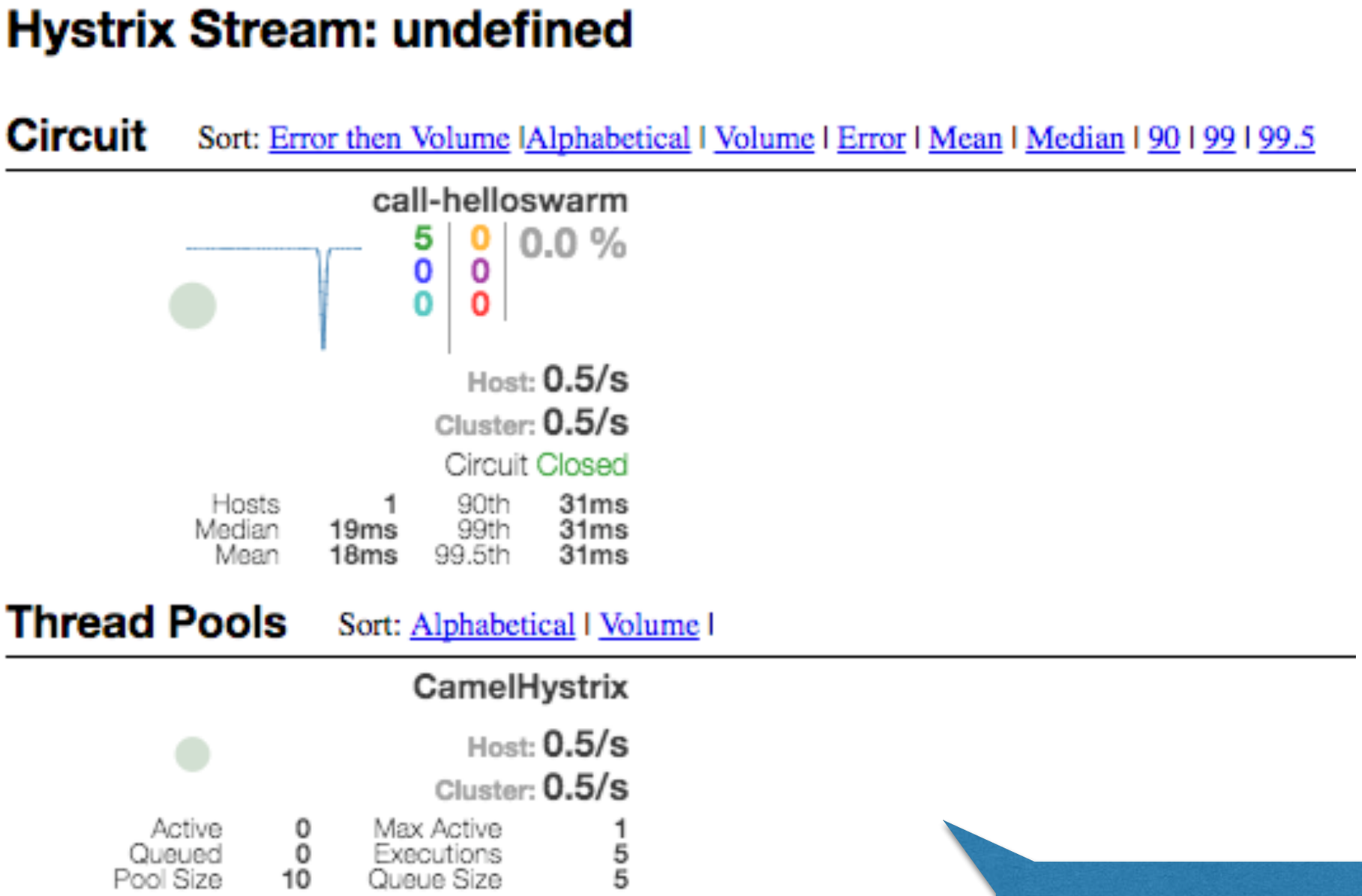


Error Handling

- Client Side Circuit Breaker with Hystrix

```
@Component
public class MyRoute extends RouteBuilder {

    @Override
    public void configure() throws Exception {
        from( uri: "timer:foo?period=2000")
            .hystrix()
                .to("http4:{{service:helloswarm}}/hello")
            .onFallback()
                .setBody().constant( value: "Nobody want to talk to me")
            .end()
                .log("${body}");
    }
}
```

Hystrix Dashboard



Instructions in readme how to install and use

Hystrix Demo

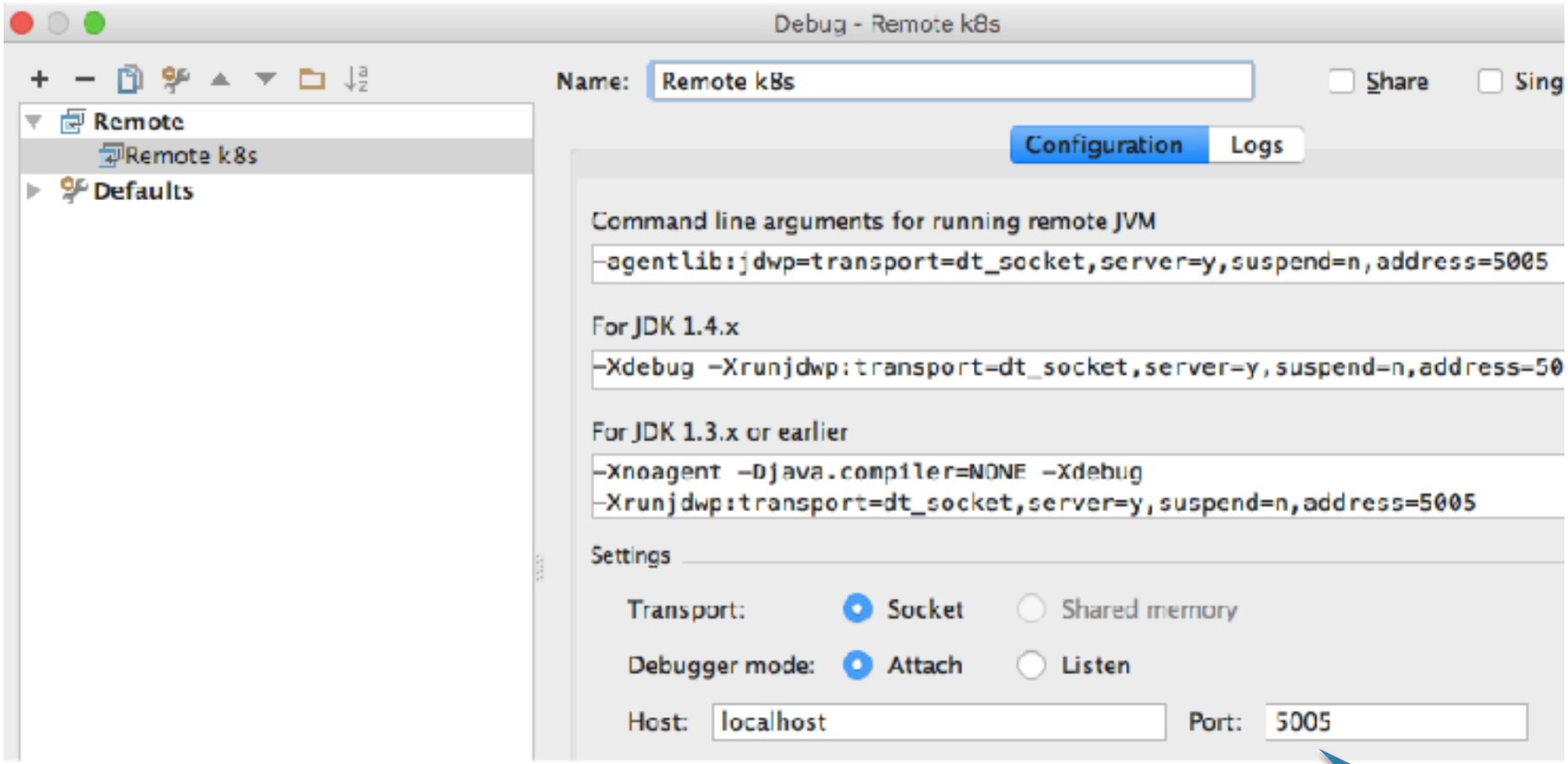
Debugging

- Debugging Pods

```
$ mvn fabric8:debug
```

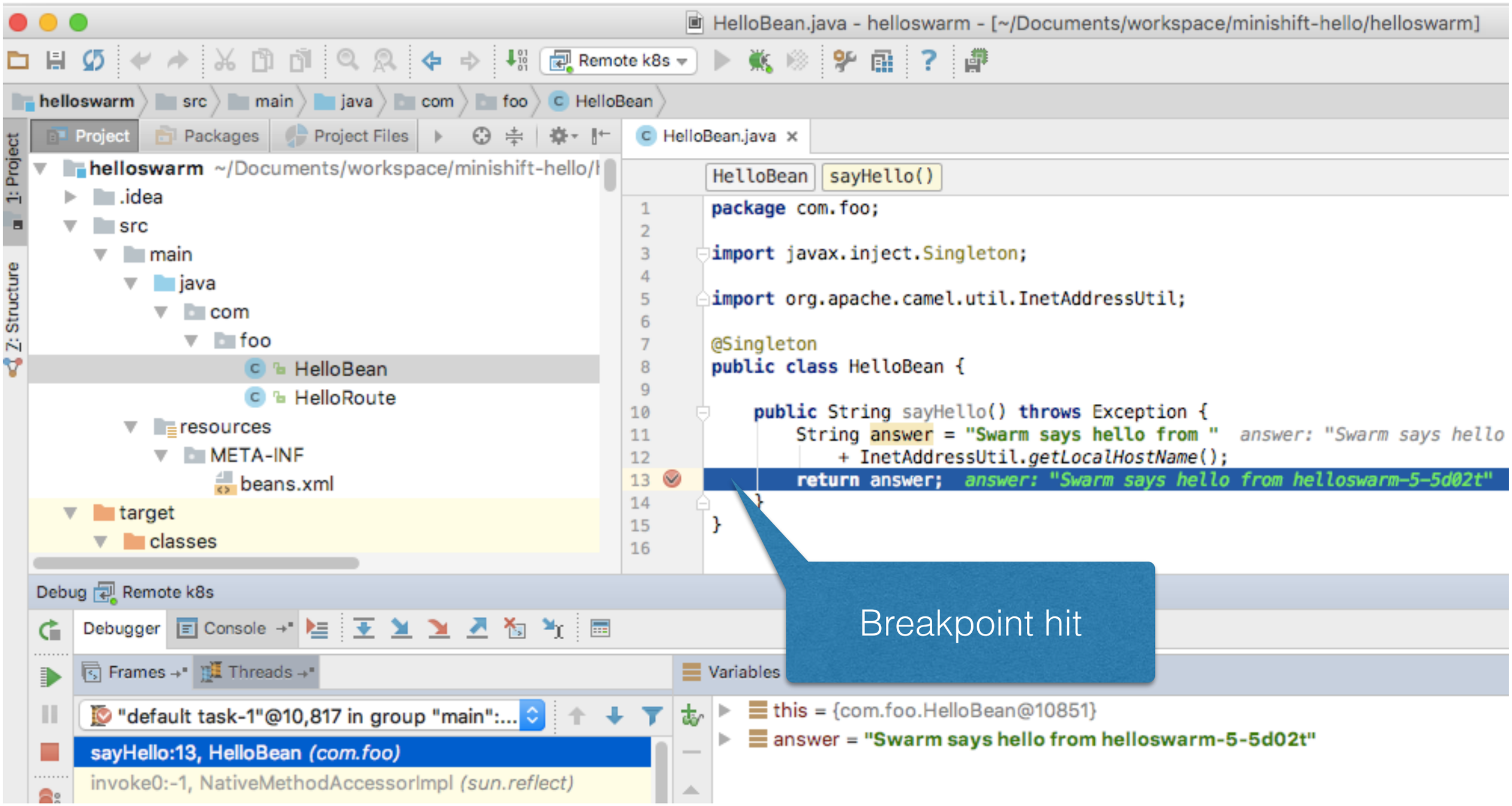
```
[INFO] F8> Port forwarding to port 5005 on pod helloswarm-1942392107-13p2p using command: kubectl
[INFO] F8> Executing command: kubectl port-forward helloswarm-1942392107-13p2p 5005:5005
[INFO] F8>
[INFO] F8> Now you can start a Remote debug execution in your IDE by using localhost and the debug port 5005
[INFO] F8>
[INFO] kubectl> Forwarding from 127.0.0.1:5005 -> 5005
[INFO] kubectl> Forwarding from [::1]:5005 -> 5005
[INFO] kubectl> Handling connection for 5005
```

Remote Debug



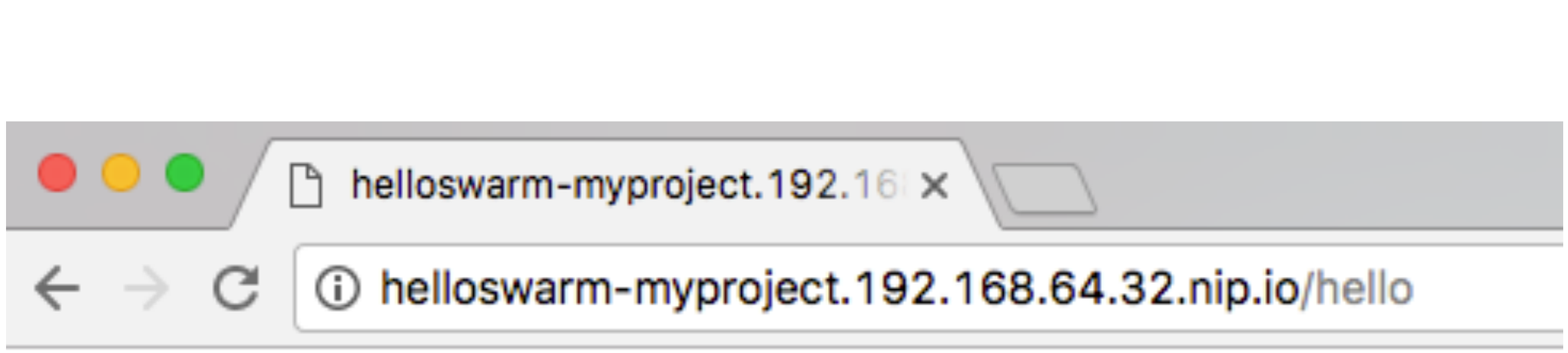
Port 5005

Remote Debug



Access Service from your computer

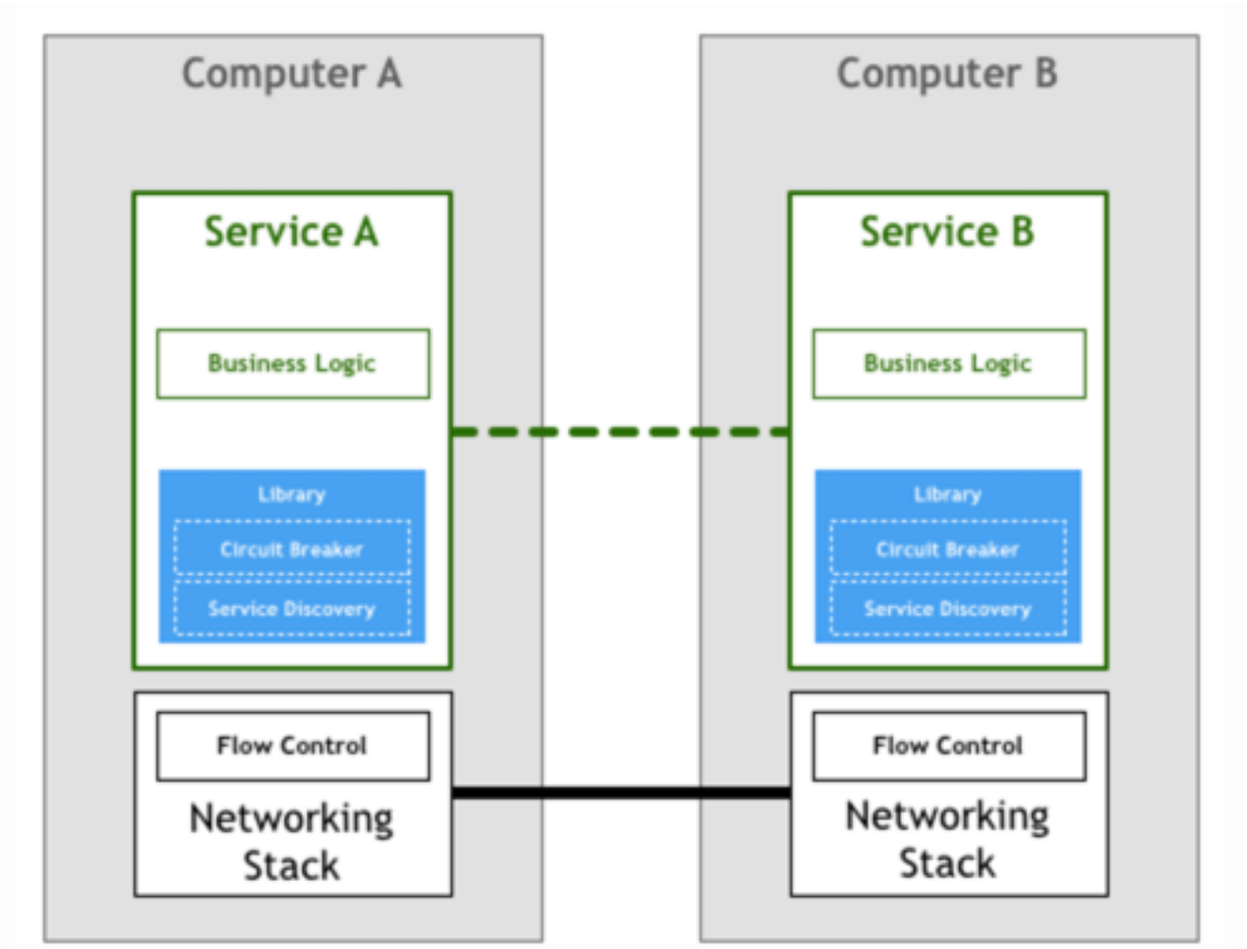
- minishift openshift service helloswarm -n myproject



Tip of Iceberg

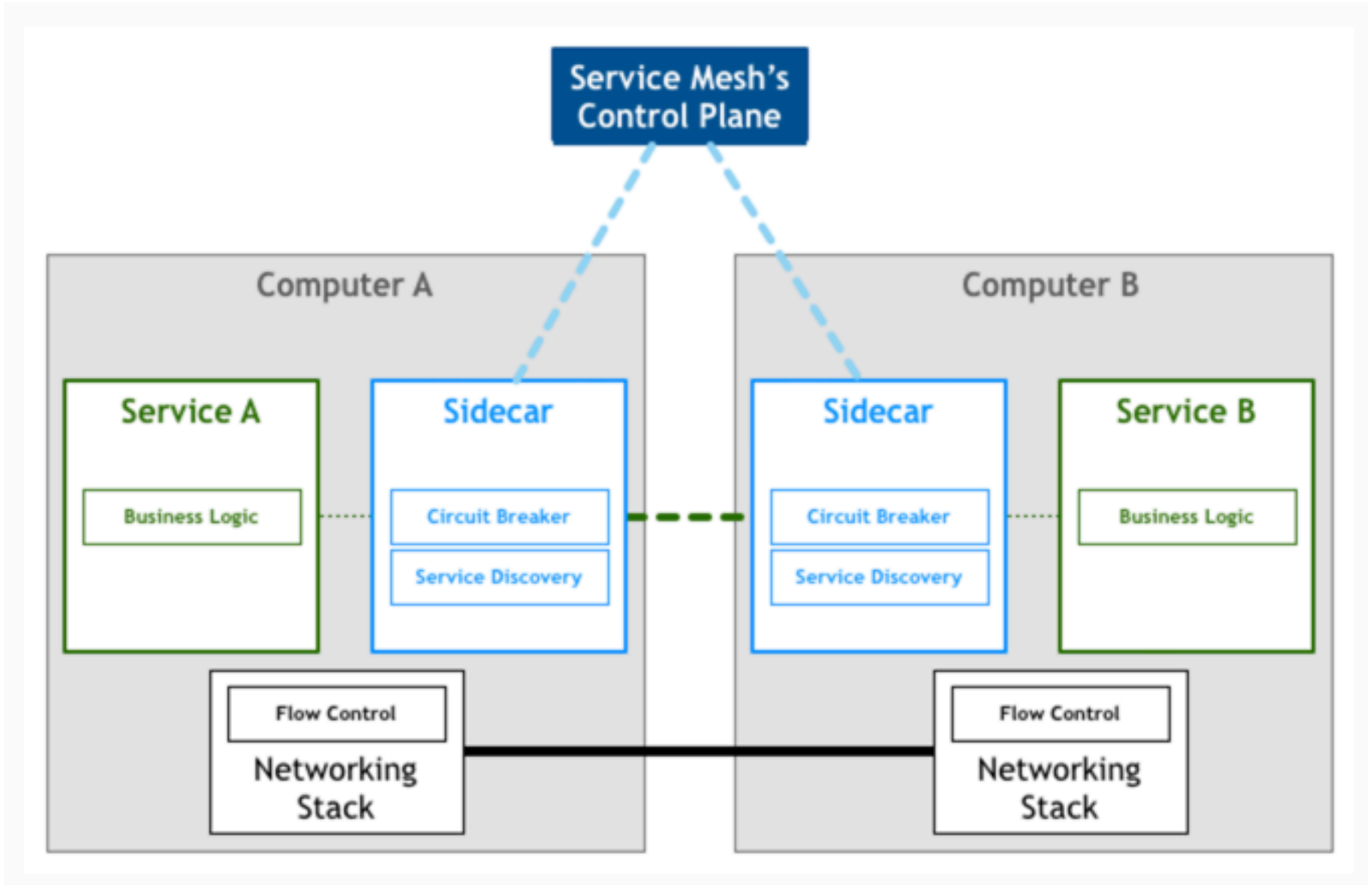
Figure by Bilgin Ibryam

Service Mesh



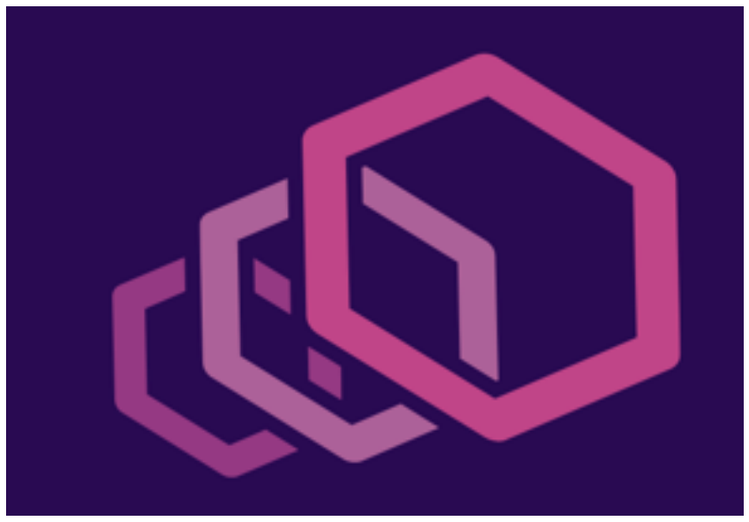
http://philcalcado.com/2017/08/03/pattern_service_mesh.html

Service Mesh



http://philcalcado.com/2017/08/03/pattern_service_mesh.html

Service Mesh Projects



Envoy

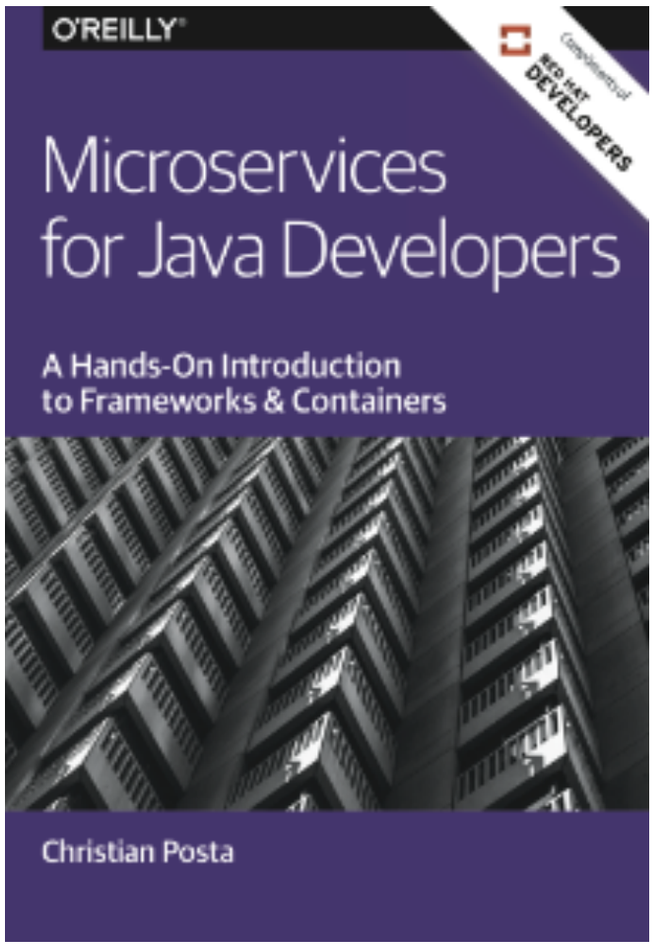
Istio

Sidecars and a Service Mesh - Video

[DevNation Live] Sidecars and a Microservices Mesh - Christian Posta

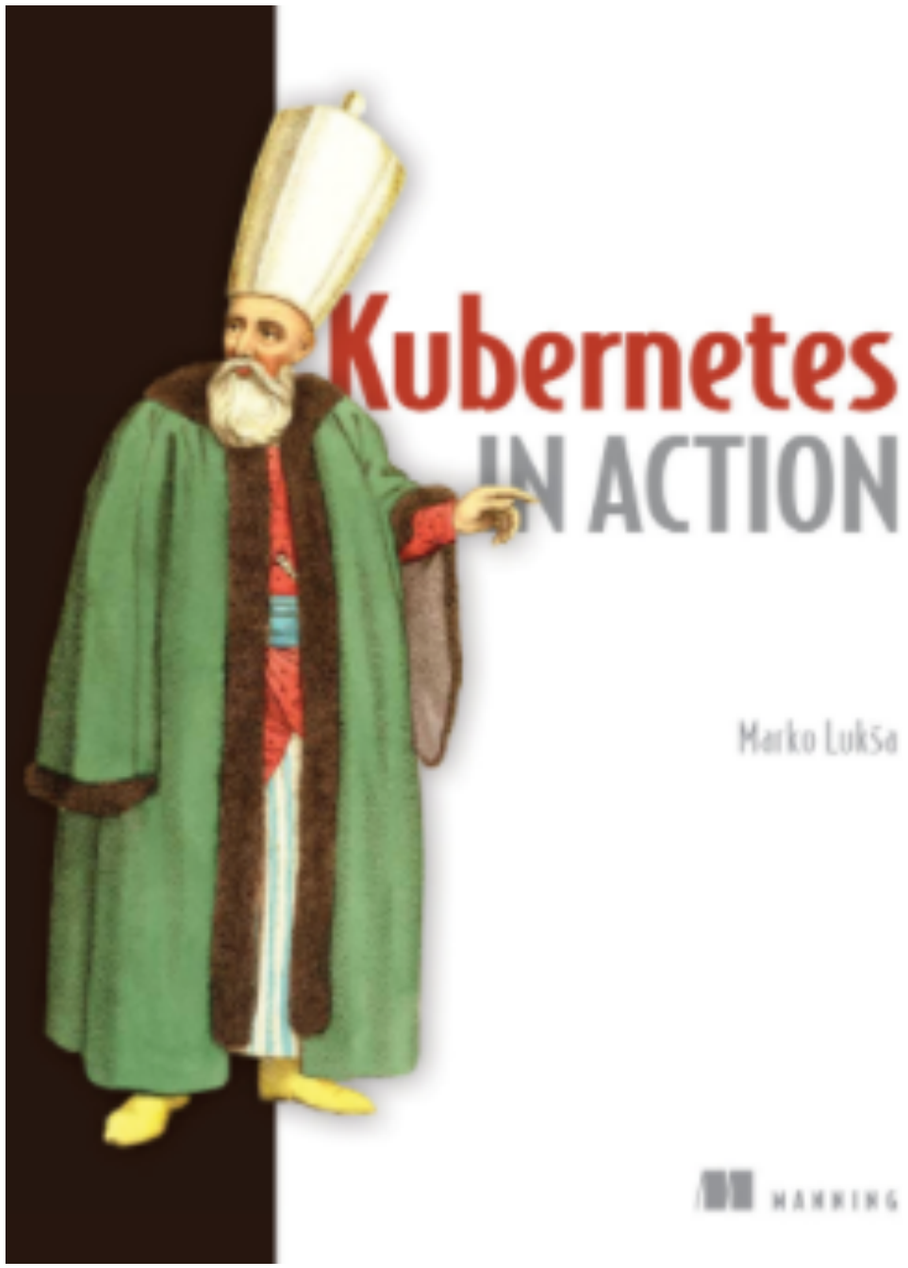
https://developers.redhat.com/devnationlive/

Free Book



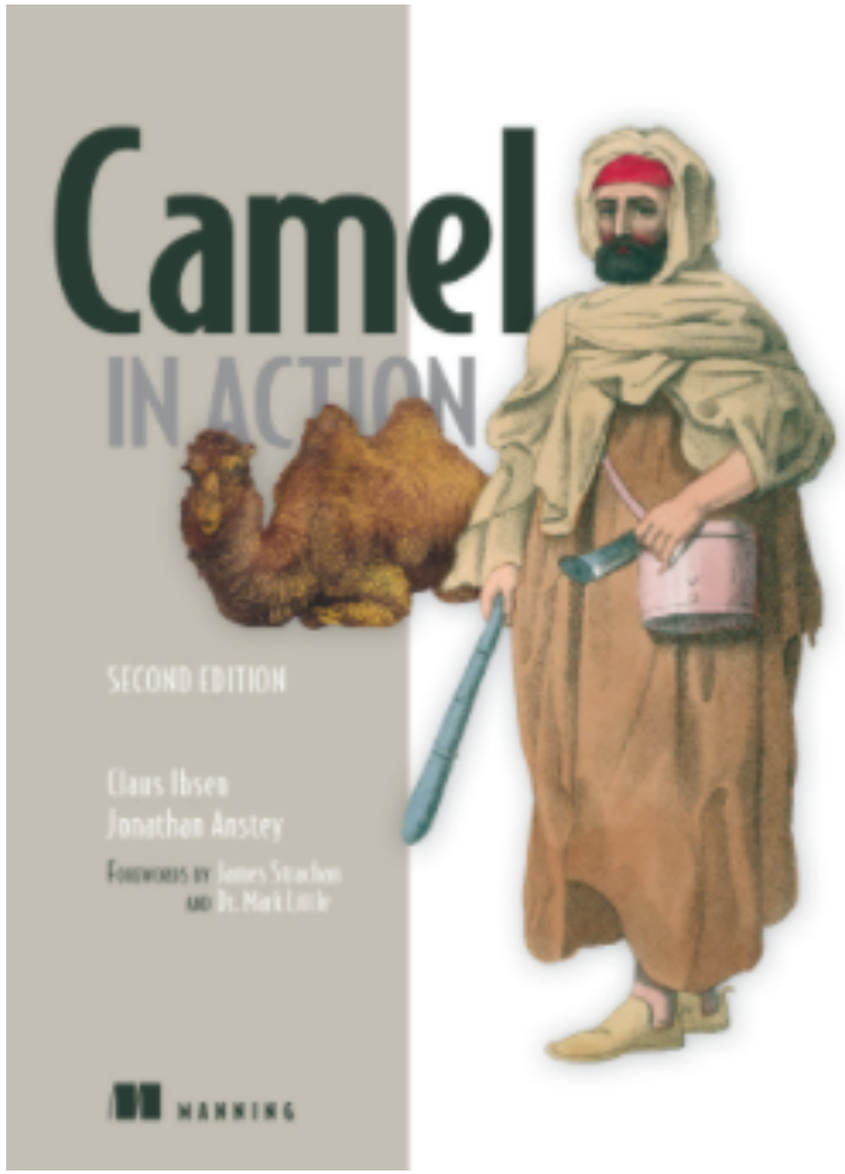
http://developers.redhat.com/promotions/microservices-for-java-developers/

Not so free Book



https://www.manning.com/books/kubernetes-in-action

Not so free Book



https://www.manning.com/books/ibsen2

Slides & Source Code

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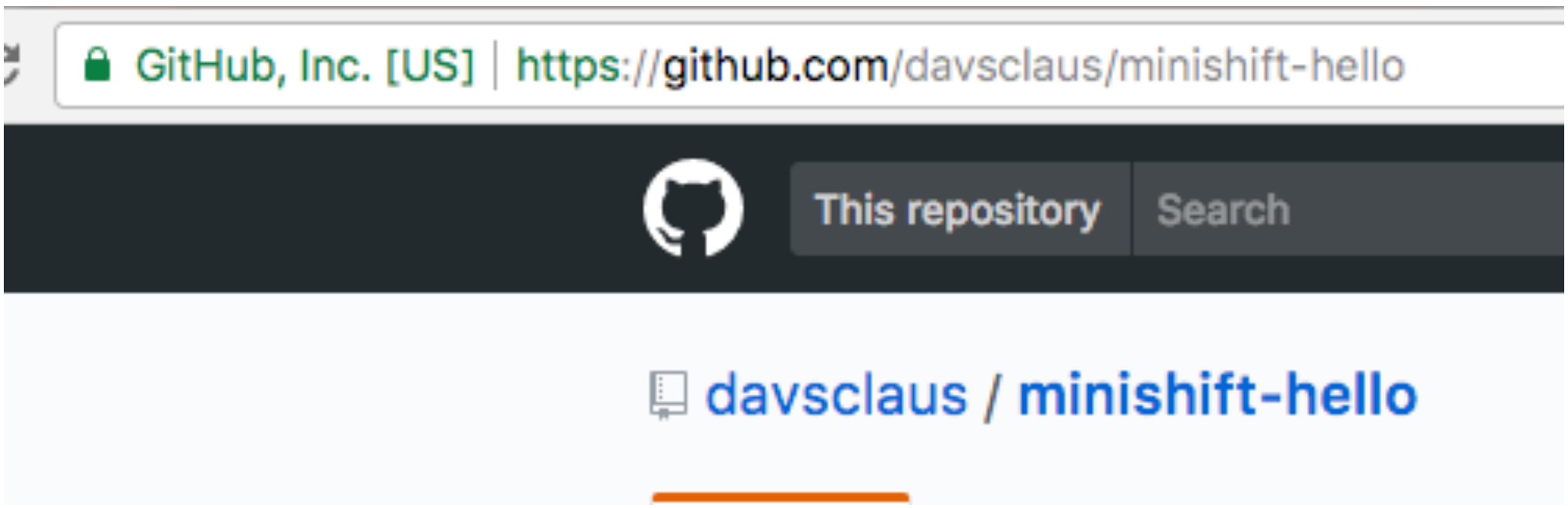

https://github.com/davsclaus/minishift-hello

ANY

QUESTIONS?