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Java Microservice Development With Apache Camel

How to develop, build and deploy microservices using Apache Camel, Spring Boot and WildFly Swarm for OpenShift / Kubernetes.

James Netherton
Red Hat Senior Software Engineer
Fuse Engineering Team

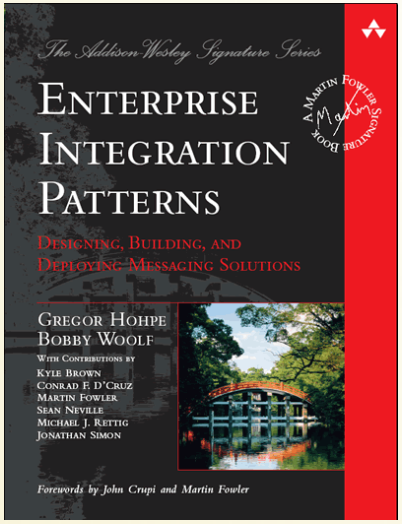
@nethertron2000 jamesnetherton

About me

- Senior Engineer at Red Hat
- Work in the JBoss Fuse engineering team
- Contribute to WildFly-Camel & Fuse Integration Services
- I like to hack on other Open Source projects
  - Camel, Fabric8, WildFly-Swarm & others

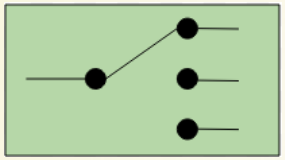
What is Apache Camel?

- Open source integration framework
- Integrate disparate systems which speak in different protocols & data formats
- Runs standalone, CDI, OSGI, Web or JavaEE containers
- Implements common Enterprise Integration Patterns

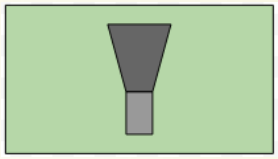


Camel EIPs

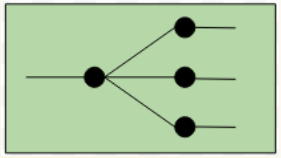
Message Router



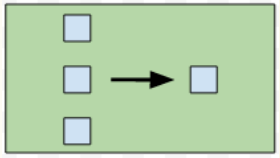
Message Filter



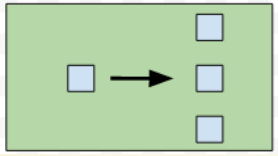
Recipient List



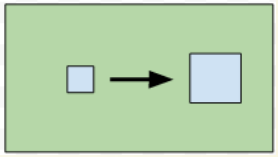
Aggregator



Splitter



Content Enricher



Camel components

Camel DSL

Java DSL

```
CamelContext camelContext = new DefaultCamelContext();
camelContext.addRoutes(new RouteBuilder() {
    @Override
    public void configure() throws Exception {
        JaxbDataFormat jaxbDataFormat = new JaxbDataFormat();
        jaxbDataFormat.setContextPath(Order.class.getPackage().getName());

        from("jms:queue:ordersIn")
        .unmarshal(jaxbDataFormat)
        .to("jpa:orders");
    }
});
```

XML

```
<camelContext>
    <route>
        <from uri="jms:queue:ordersIn"/>
        <unmarshal>
            <jaxb contextPath="org.example.com.Order"/>
        </unmarshal>
        <to uri="jpa:orders"/>
    </route>
</camelContext>
```

Microservices

"An approach to developing a single application as a suite of small services, each running in its own process and communicating with lightweight mechanisms"

http://www.martinfowler.com/articles/microservices.html

Microservices

- Organised around business capabilities
- Independently replacable, upgradable, scalable
- Communicate with other services via the APIs they expose
- Resilient & designed for failure

Java Microservice frameworks

- Many Java Microservice frameworks have converged on producing executable JARs

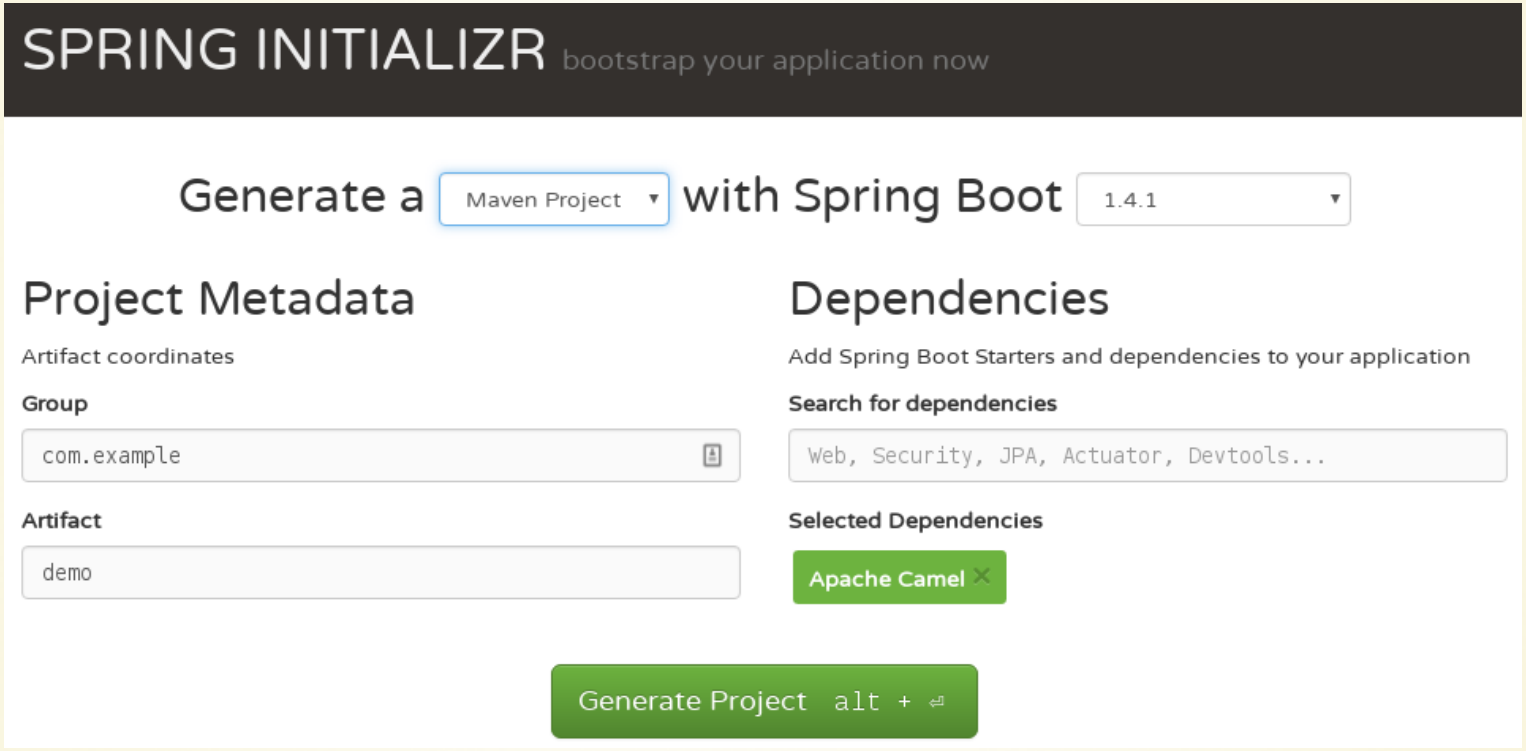
Spring Boot Camel applications

- Integration via the Spring Boot component

  http://camel.apache.org/spring-boot.html
- Configure Camel via application.properties (or YAML)
- Generate Camel apps with the Spring initializr

  http://start.spring.io/

Spring Boot Camel applications



Spring Boot Camel applications

- New in Camel 2.18!
  - Camel Spring Boot BOM
  - Camel component Spring Boot starter dependencies
  - Camel health checks via Spring Boot Actuator
  - Component properties support in application.yml with IDE auto-complete support

Spring Boot Camel applications

```
<dependencyManagement>
  <dependencies>
    <dependency>
      <groupId>org.apache.camel</groupId>
      <artifactId>camel-spring-boot-bom</artifactId>
      <version>2.18.0</version>
      <scope>import</scope>
      <type>pom</type>
    </dependency>
  </dependencies>
</dependencyManagement>

<dependencies>
  <dependency>
    <groupId>org.apache.camel</groupId>
    <artifactId>spring-boot-starter-undertow</artifactId>
  </dependency>
</dependencies>

<plugin>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-maven-plugin</artifactId>
  <executions>
    <execution>
      <goals>
        <goal>repackage</goal>
      </goals>
    </execution>
  </executions>
</plugin>
```

Spring Boot Camel applications

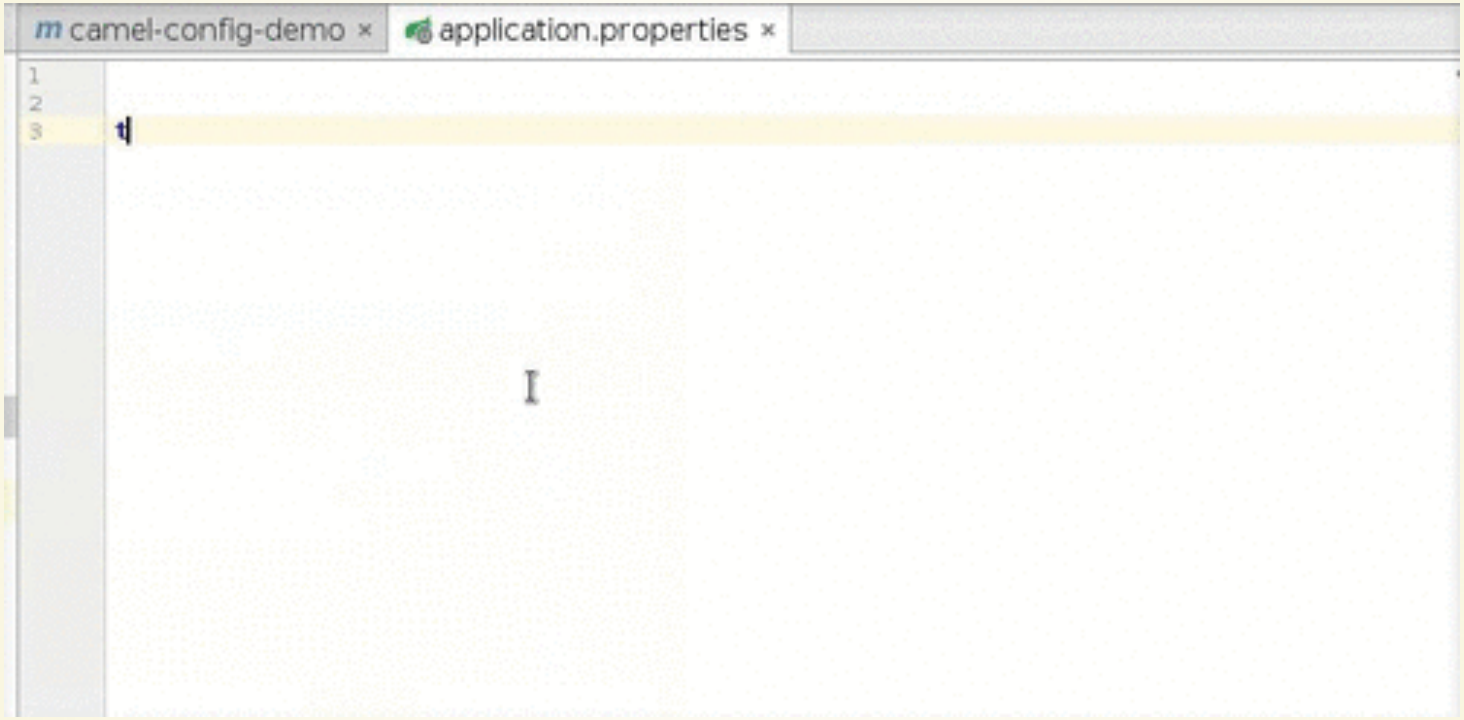
```
@SpringBootApplication
public class MyCamelSpringBootApplication {

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

```
@Component
public class HelloWorldRouteBuilder extends RouteBuilder {

    public void configure() throws Exception {
        from("undertow:http://0.0.0.0:8080/hello")
        .setBody(constant("Hello World!"))
    }
}
```

Spring Boot Camel applications

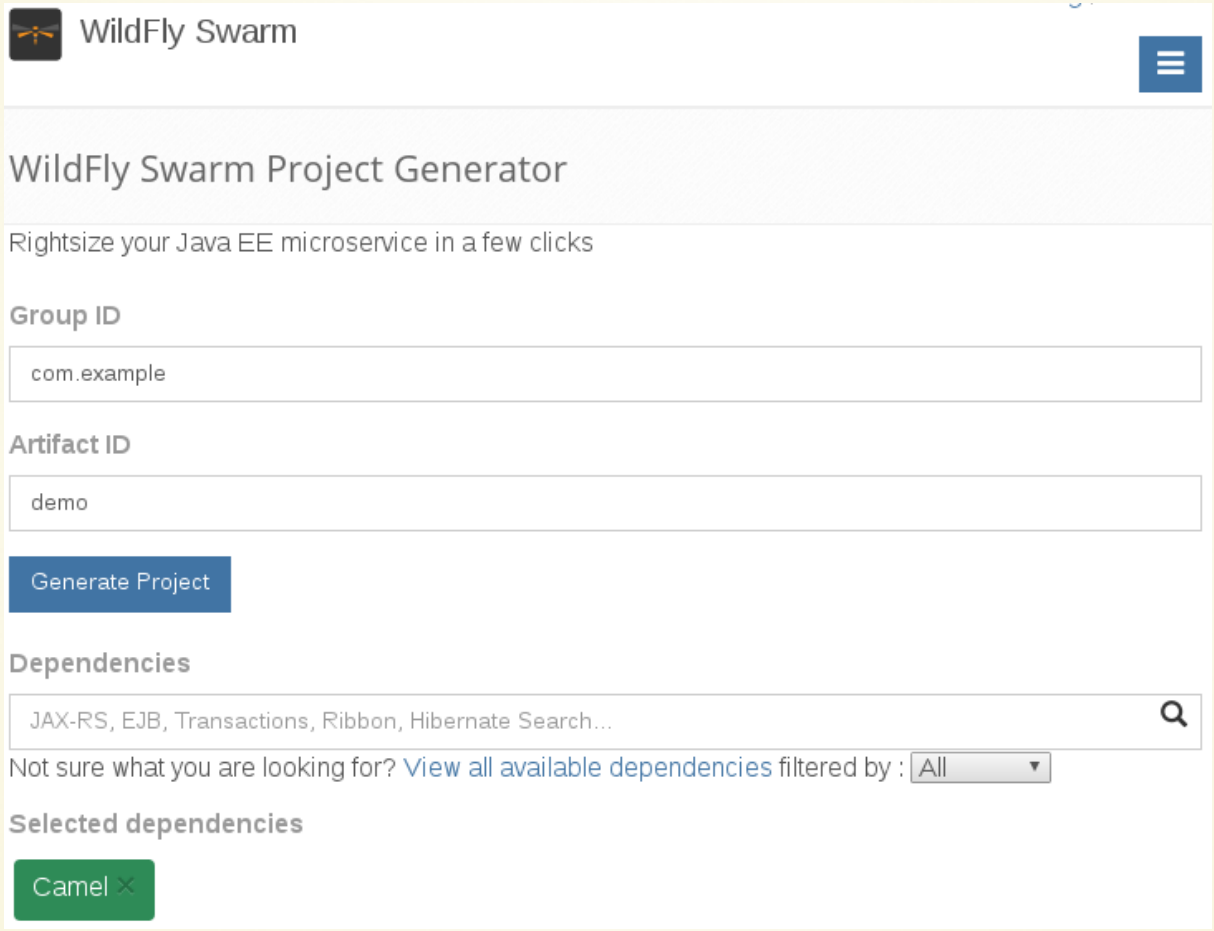


https://www.nicolaferraro.me/2016/09/25/apache-camel-meets-spring-boot/

WildFly Swarm Camel applications

- Utilises the WildFly-Camel subsystem
  https://github.com/wildfly-extras/wildfly-camel
- Use Camel APIs in your JavaEE Microservices
- Generate Camel apps with the WildFly Swarm generator
  http://wildfly-swarm.io/generator/

WildFly Swarm Camel applications



WildFly Swarm Camel applications

```
<dependencyManagement>
  <dependencies>
      <dependency>
        <groupId>org.wildfly.swarm</groupId>
        <artifactId>bom-all</artifactId>
        <version>2016.10.0</version>
        <scope>import</scope>
        <type>pom</type>
      </dependency>
  </dependencies>
</dependencyManagement>

<dependencies>
  <dependency>
    <groupId>org.wildfly.swarm</groupId>
    <artifactId>camel-undertow</artifactId>
  </dependency>
</dependencies>

<plugin>
  <groupId>org.wildfly.swarm</groupId>
  <artifactId>wildfly-swarm-plugin</artifactId>
  <version>2016.10.0</version>
  <executions>
    <execution>
      <goals>
        <goal>package</goal>
      </goals>
    </execution>
  </executions>
```

WildFly Swarm Camel applications

```
public class Main {

    public static void main(Stirng args[]) {
        Swarm swarm = new Swarm()
        swarm.fraction(new CamelCoreFraction().addRouteBuilder("rest-context",
            new RouteBuilder() {
                @Override
                public void configure() throws Exception {
                    from("undertow:http://localhost/hello")
                    .log("Hello World!");
                }
        });

        swarm.start();
    }
}
```

Camel Microservice support

- Components
  - JDBC, MongoDB, JMS, Kafka, NATS, Chronicle
- Data formats
  - REST, XML, JSON, YAML, protocol buffers
- EIPs
  - Circuit breaker
  - Load balancer
- Configuration
  - Environment variables
  - Kubernetes ConfigMap

Camel Microservice configuration

- Environment variables

```
ORDERS_SERVICE_HOST=10.0.162.149
ORDERS_SERVICE_PORT=80
```

Standard environment variable property interpolation

```
public void configure() {
    from("jms:queue:orders")
    .to("http:{{ORDERS_SERVICE_HOST}}:{{ORDERS_SERVICE_PORT}}/api");
}
```

Service environment variable property interpolation

```
public void configure() {
    from("jms:queue:orders")
    .to("http:{{service:ORDERS}/api");
}
```

Camel Microservice configuration

Kubernetes ConfigMap

- Separates configuration from the Docker image
- Can be used to provide environment variables or can be read from the file system

Camel Microservice configuration

ConfigMap with Spring Cloud Kubernetes

- Specify Spring Boot application config in ConfigMaps
- Supports app reloading in response to ConfigMap updates

https://github.com/fabric8io/spring-cloud-kubernetes

Camel Microservice build & deployment

Typical use case workflow

- We want to:
  - Build the application
  - Generate a Docker image composed of our runnable JAR
  - Run the Docker image in a clustered environment like Kubernetes or OpenShift

Camel Microservice build & deployment

Which usually means:

- Configuring a Maven plugin to build Docker images
- Specifying desired Kubernetes resources in YAML / JSON
- Apply Kubernetes resources to the cluster

Camel Microservice build & deployment

Fabric8 Maven Plugin (f-m-p) to the rescue!

- Uses generators and encrichers to make opinionated decisions on how an app is built
- Generates Docker images & Kubernetes resources
- Highly extendable and configurable

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

Camel Microservice build & deployment

- Basic workflow:
  - Generate resources - fabric8:resource
  - Build docker images - fabric8:build
  - Deploy changes - fabric8:deploy
- Also supports OpenShift S2I workflow

Camel Microservice build & deployment

- Generators
  - Spring Boot
  - WildFly Swarm
  - Web Application
  - Karaf
- Determines the type of application being built and configures appropriate defaults:
  - Docker base image
  - Health & readiness checks
  - Exposed ports, startup command and more

Camel Microservice build & deployment

There's more!

Tail pod logs	fabric8:log
In-container debugging	fabric8:debug
Watch for changes	fabric8:watch
Start application	fabric8:start
Stop application	fabric8:stop
Delete application	fabric8:undeploy

Camel Microservice testing

- Camel has a comprehensive test framework for various technologies:
  - Spring
  - CDI
  - OSGi

http://camel.apache.org/testing.html

Camel Microservice testing

Fabric8 Arquillian

- Integration testing on OpenShift & Kubernetes
- Provision & orchestrate containers
- Assertj based DSL to verify the expected resources are running

https://github.com/fabric8io/fabric8/tree/master/components/fabric8-arquillian

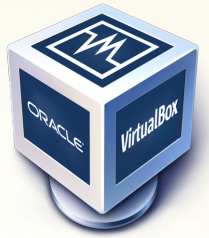
Camel Microservice testing

```
@RunWith(Arquillian.class)
@RunAsClient
public class KubernetesIntegrationTest {

    @ArquillianResource
    KubernetesClient client;

    @Test
    public void testAppProvisionsRunningPods() throws Exception {
        assertThat(client).deployments().pods().isPodReadyForPeriod();
    }
}
```

Setting up local clusters for development



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CONTAINER
DEVELOPMENT KIT

- Or you could just run natively
- Or better still...

Setting up local clusters for development

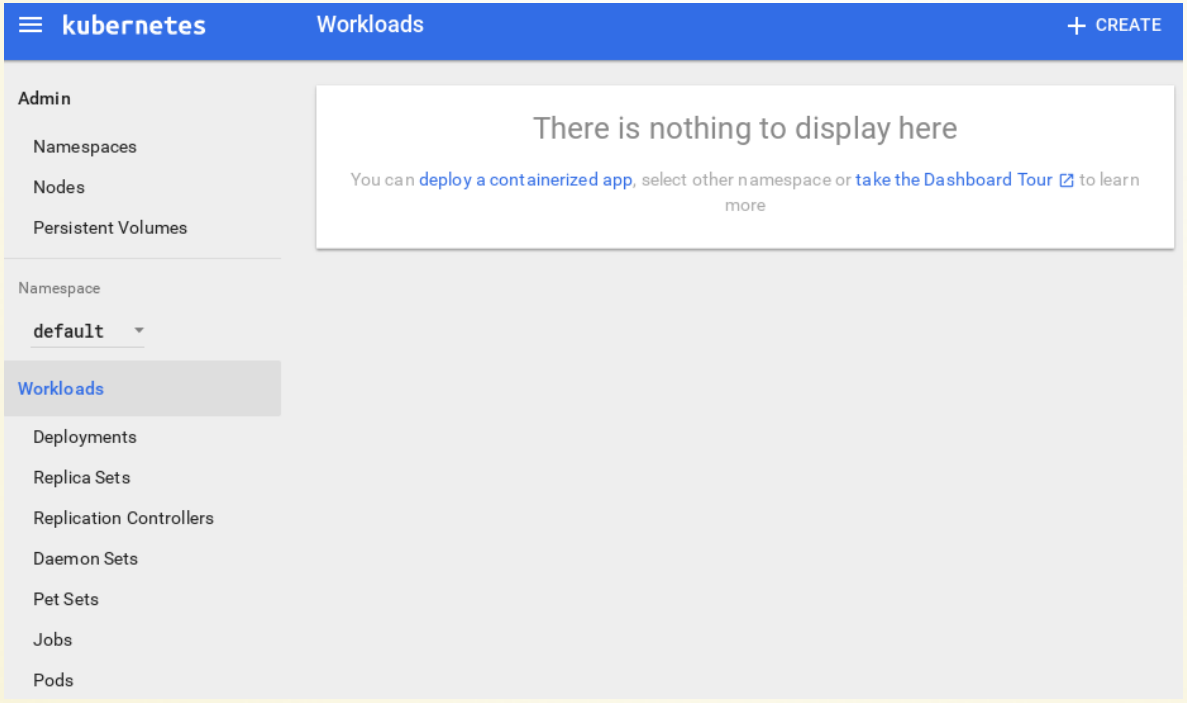
- Minikube

  https://github.com/kubernetes/minikube
- Minishift

  https://github.com/MiniShift/minishift
- Runs a single node local cluster within a lightweight VM

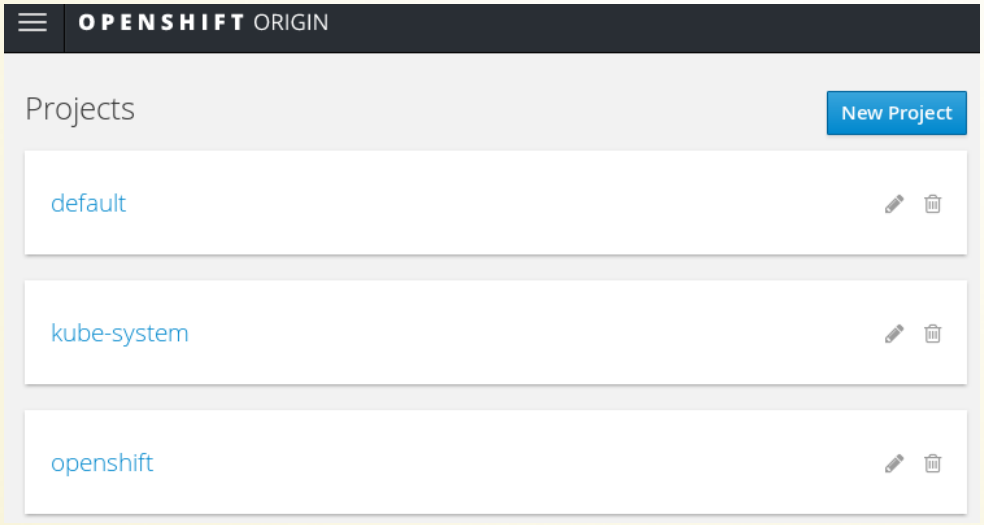
Setting up local clusters for development

```
$ minikube start

Starting local Kubernetes cluster...
Kubectl is now configured to use the cluster.


$ minikube dashboard

Opening kubernetes dashboard in default browser...
```



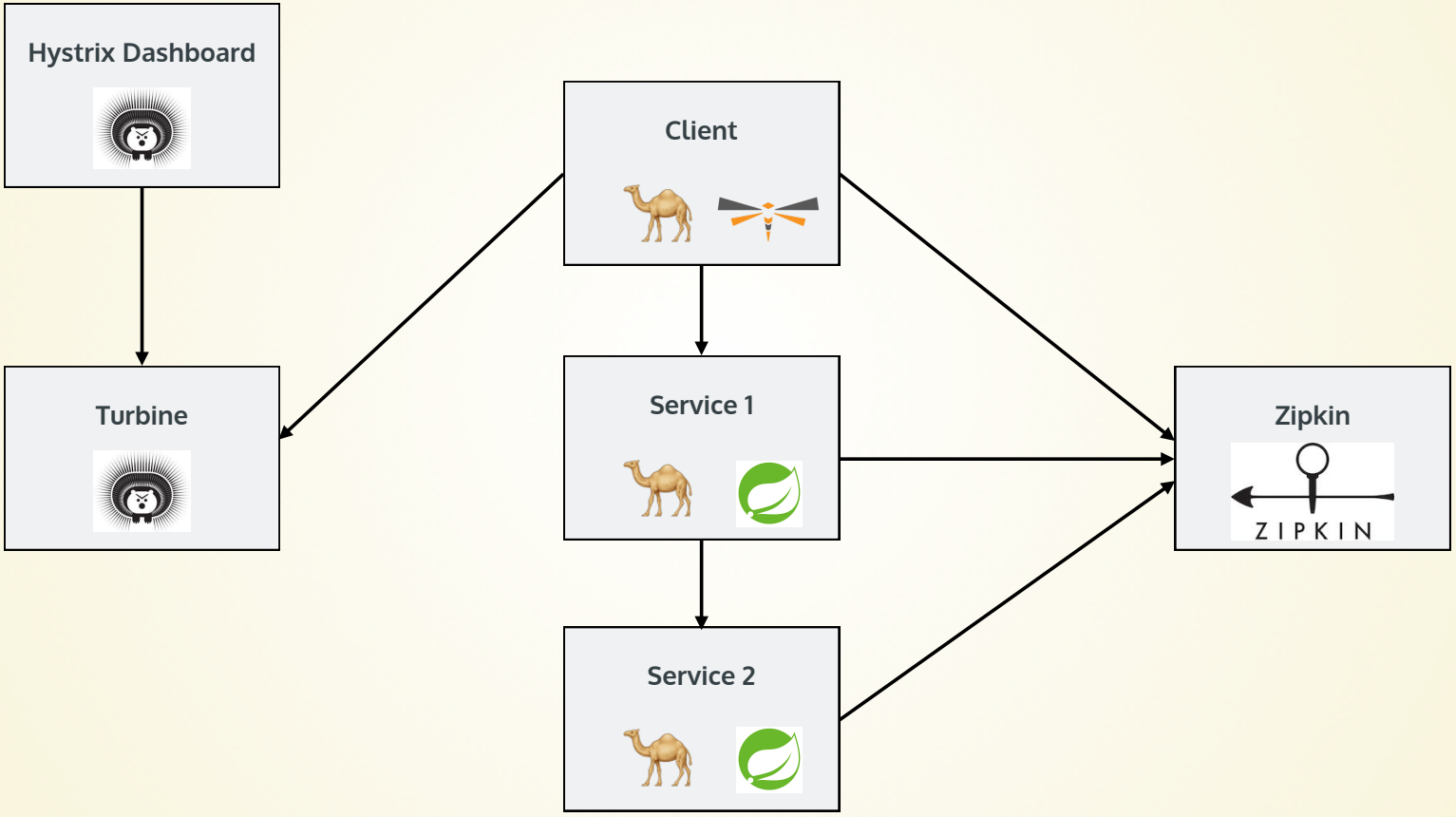
Setting up local clusters for development

```
$ minishift start --insecure-registry=my-insecure-registry.org \
                  --deploy-router=true

Starting local OpenShift cluster...
oc is now configured to use the cluster.
Run this command to use the cluster:
oc login --username=admin --password=admin

$ minishift console

Opening OpenShift console in default browser...
```



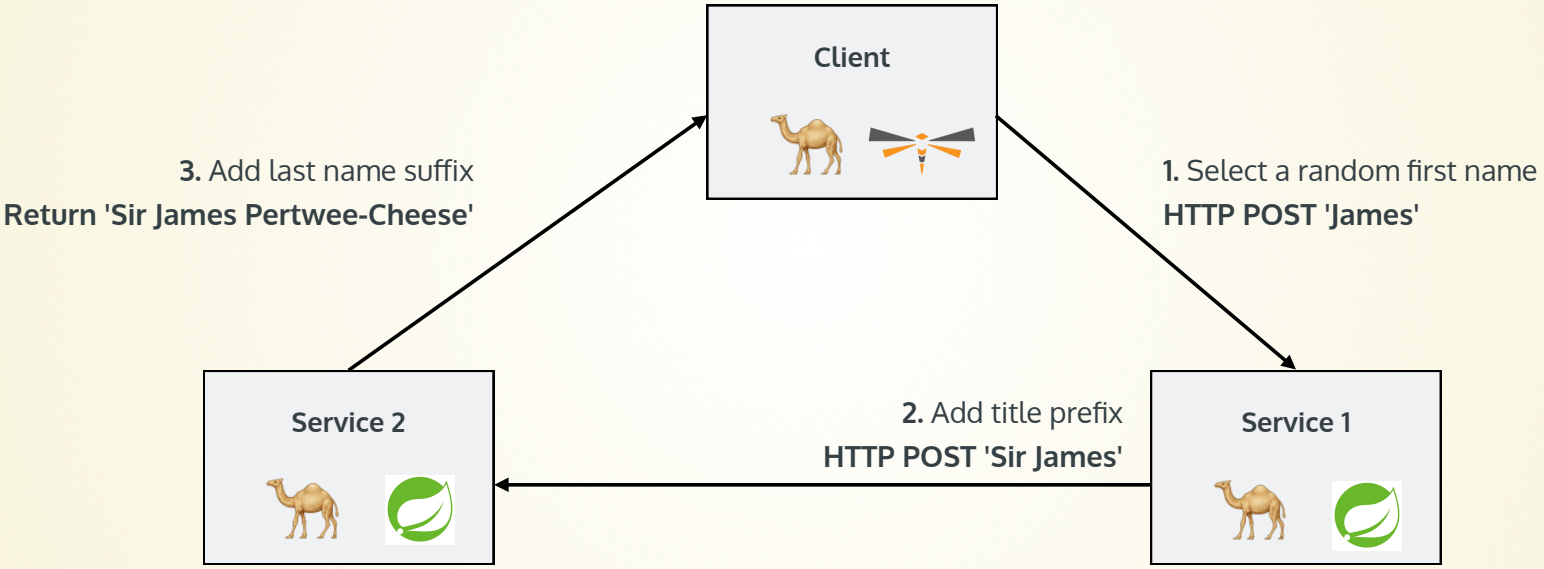
DEMO TIME

Camel Microservice demo



Camel Microservice demo

Name generator



Camel Microservice demo

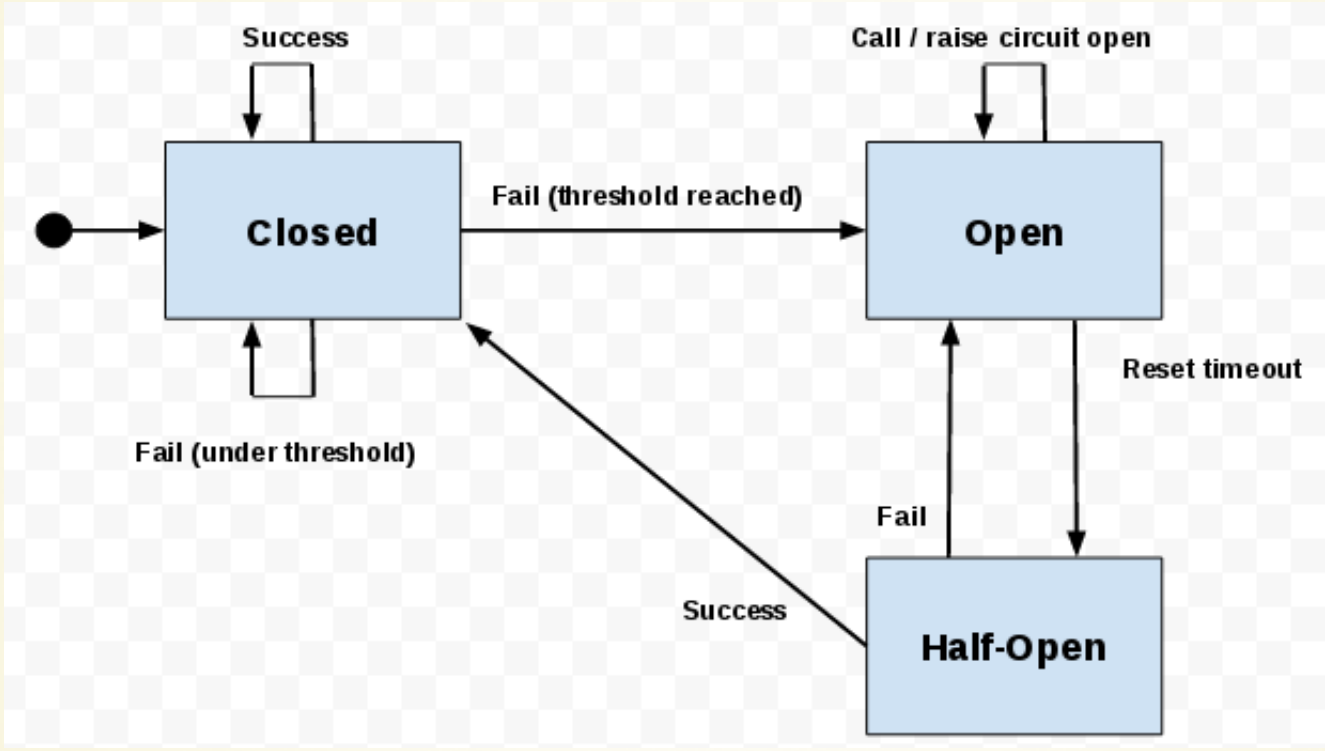
Building for resilience

- Things ***will*** fail
- Camel Hystrix component + circuit breakers can help:

"*Wrap a protected function call in a circuit breaker object, which monitors for failures. Once the failures reach a certain threshold, the circuit breaker trips, and all further calls to the circuit breaker return with an error, without the protected call being made at all*"

http://martinfowler.com/bliki/CircuitBreaker.html

Camel Microservice demo



Camel Microservice demo

```
public void configure() throws Exception {
    from("direct:start")
    .hystrix()
        .hystrixConfiguration()
            .executionTimeoutInMilliseconds(5000)
        .end()
        .to("jetty:http://mydomain.com/some-endpoint")
        .onFallback()
            .setBody(constant("I'm not available right now"))
        .end()
}
```

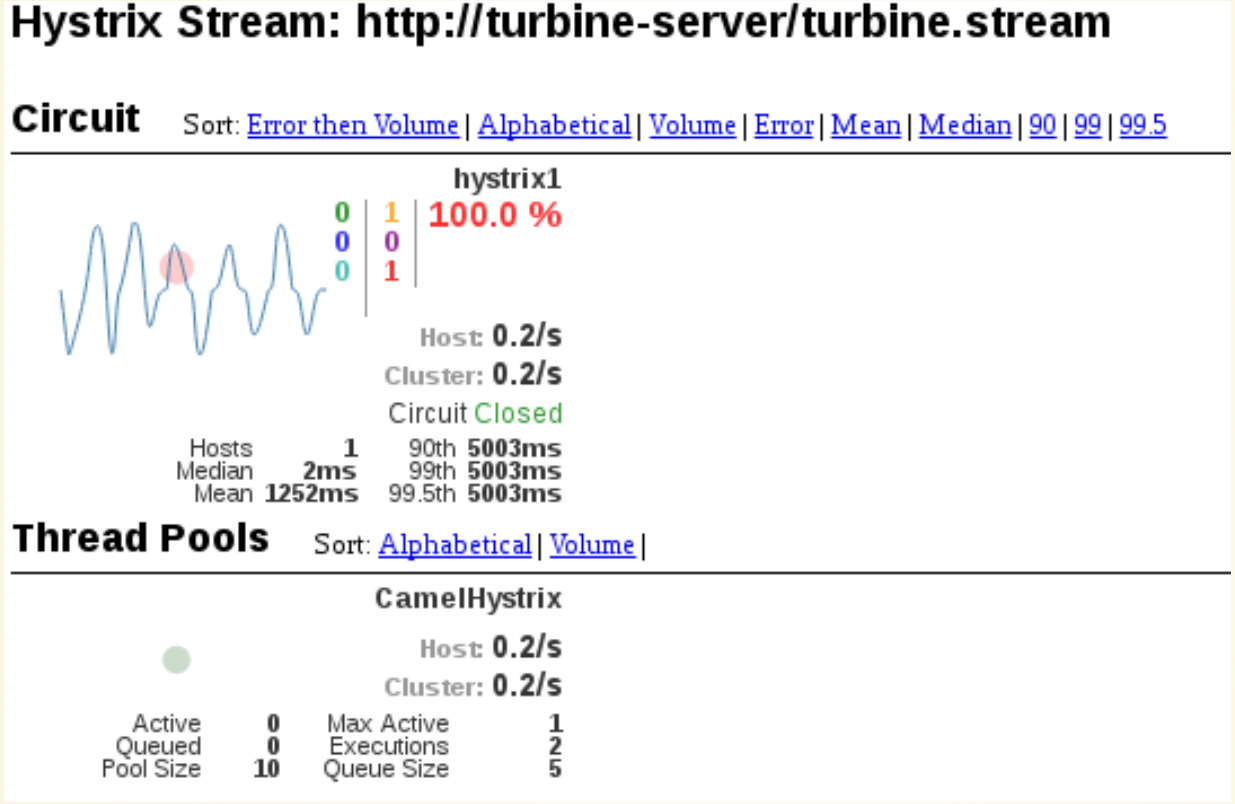
Camel Microservice demo

- Kubeflix
  - Kubernetes discovery for Hystrix & Turbine
  - Docker images for Turbine and Hystrix Dashboard
  - Discovery works via a simple label annotations

    https://github.com/fabric8io/kubeflix

```
metadata:
  labels:
    hystrix.enabled: "true"
```

Camel Microservice demo

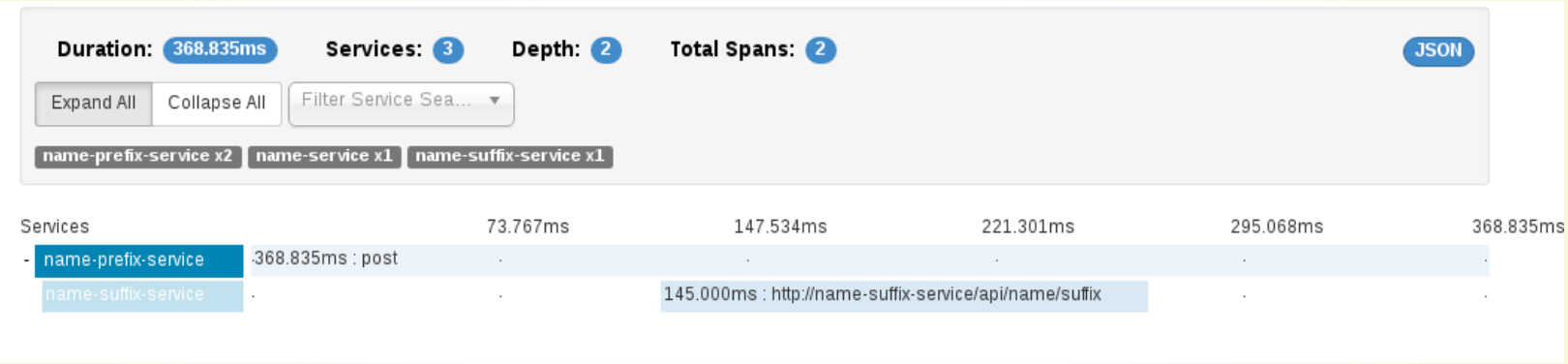


Camel Microservice demo

Distributed tracing

- Camel Zipkin component can capture timings for incoming & outgoing messages
- Publish trace metrics to Zipkin collector server
- View the results in Zipkin web UI

Camel Microservice demo



Links

Projects

http://camel.apache.org

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

http://wildfly-swarm.io

https://kubernetes.io

https://openshift.org

Examples

https://github.com/jamesnetherton/camel-microservice-demo

https://github.com/fabric8-quickstarts

https://github.com/wildfly-swarm/wildfly-swarm-examples

My ramblings

https://twitter.com/nethertron2000

https://jamesnetherton.github.io