Microservices with Java, Spring Boot & Spring Cloud

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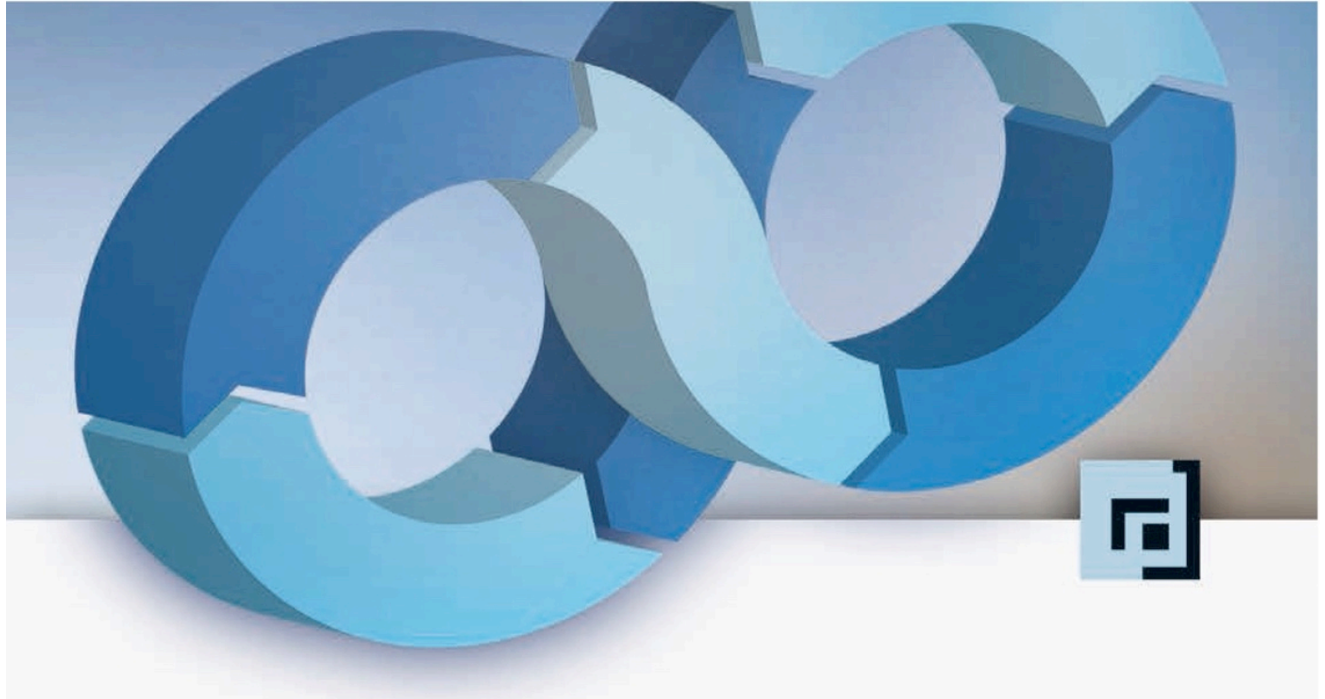


Eberhard Wolff

Continuous Delivery

Der pragmatische Einstieg

dpunkt.verlag

Eberhard Wolff

Microservices

Grundlagen flexibler Softwarearchitekturen

dpunkt.verlag

http://microservices-buch.de/

Microservices

Flexible Software Architectures

Eberhard Wolff

http://microservices-book.com/

Microservices Primer

A Short Overview

Eberhard Wolff

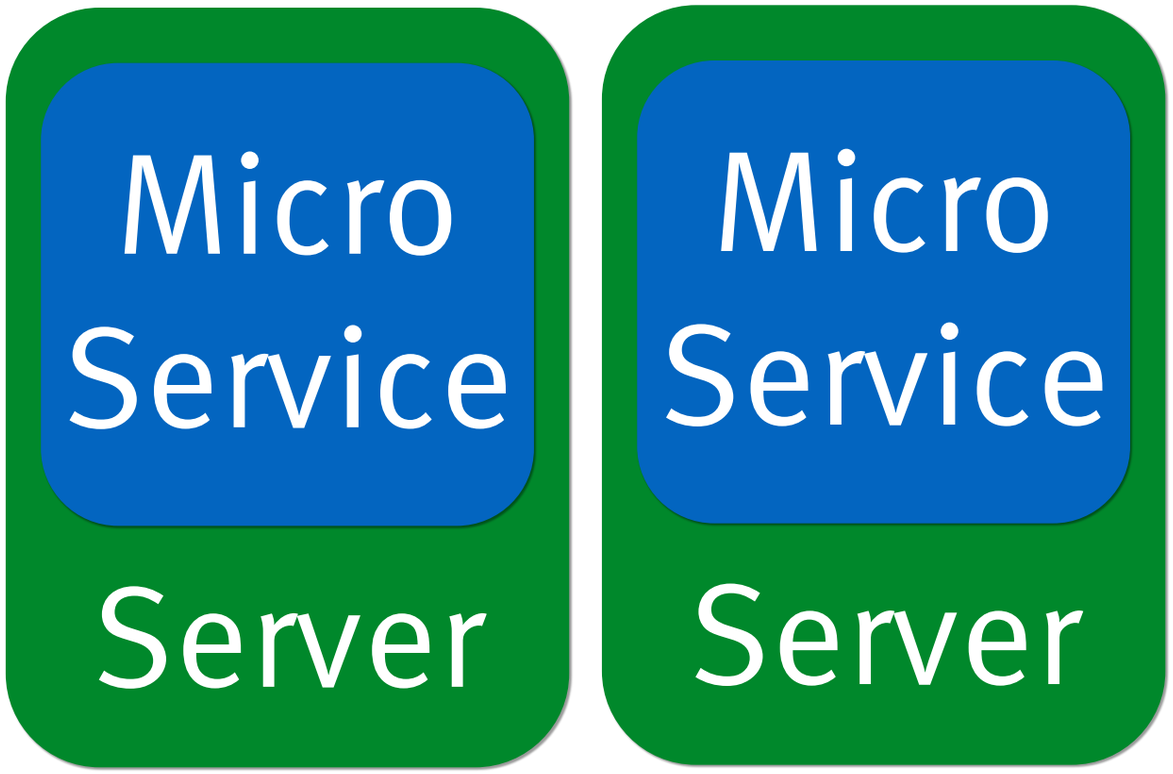
FREE!!!!

http://microservices-book.com/primer.html

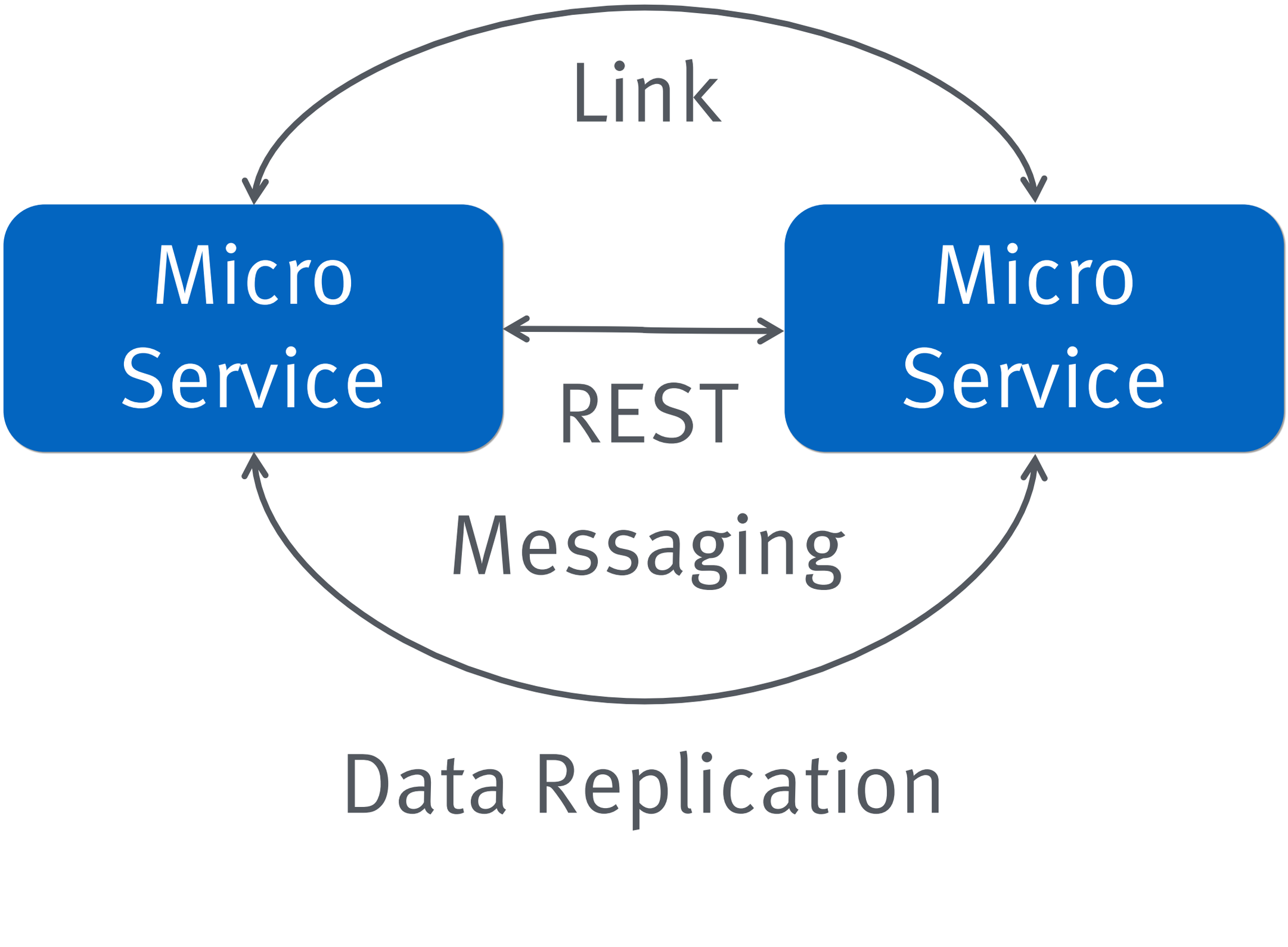
Microservice Definition

Microservices: Definition

- Small
- Independent deployment units
- Any technology
- Any infrastructure



Components Collaborate



Infrastructure

- ...must support lots of services
- Easy to create a new project
- REST integrated
- Messaging supported
- Uniform operations

Spring Boot Demo

Simple Infrastructure

- One pom.xml
- ...or Gradle / Ant
- Very few dependencies
- One plug in
- Versions defined

REST Integrated

- Support in Spring MVC
- As we have seen

- Also: JAX-RS
- Jersey

Messaging Support

- Numerous Spring Boot Starter
  - AMQP (RabbitMQ)
  - HornetQ (JMS)
  - ActiveMQ Artemis (JMS)

Messaging Support

- Spring JMS abstraction
- Message driven POJOs
- Scalable
- Simplify sending JMS
- Can use other libs, too!
- Boot: everything Spring / Java can do

Infrastructure

- ...must support lots of services

- ✓ Easy to create a new project
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- Simple deployment
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Deploy

- Package everything in an executable JAR
- ...or a WAR
- Based on Maven, Ant or Gradle
- Add configuration

Spring Boot Deploy Demo

Deploy

- Install a basic machine
- Install Java
- Copy over JAR
- Optional: Make it a Linux Service
- ...just a link
- Optional: Create application.properties

Infrastructure

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Spring Boot Actuator

- Provide information about the application
- Via HTTP / JSON
- ...or Metrics

- Can be evaluated by monitoring tools etc.
- E.g. Graphite, Grafana ....

Spring Boot Actuator Demo

- https://github.com/ewolff/user-registration-V2

- Logging ELK
- Subdir log-analysis

- Monitoring Graphite
- Subdir graphite

Infrastructure

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Spring Cloud

Based on Spring Boot

Supports many technology stacks,

Clouds,

...

Focus: Netflix Stack

Spring Cloud Netflix

Zuul
Routing

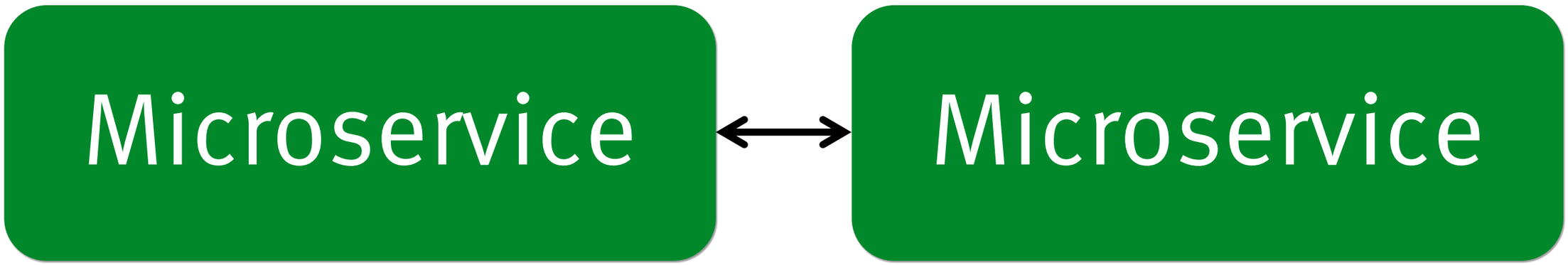
Ribbon
Client Side
Load Balancing

Eureka
Service Discovery

Hystrix
Resilience

Coordinating Microservices

- Must find each other



Service Discovery

Eureka

Why Eureka?

- REST based service registry
- Supports replication
- Caches on the client
- Resilient
- Fast
- ...but not consistent
- Foundation for other services

Eureka Client in Spring Cloud

- @EnableDiscoveryClient: generic
- @EnableEurekaClient: more specific
- Dependency to spring-cloud-starter-eureka
- Automatically registers application

application.properties

Eureka server
Can include user / password

```
eureka.client.serviceUrl.defaultZone=http://host:8761/eureka/

eureka.instance.leaseRenewalIntervalInSeconds=5

spring.application.name=catalog

eureka.instance.metadataMap.instanceId=${spring.application.name}:${r
    andom.value}

eureka.instance.preferIpAddress=true
```

Faster updates

Used for registration
In CAPITAL caps

Docker won't resolve host names

Need unique ID
Load balancing

Eureka Server

```
@EnableEurekaServer

@EnableAutoConfiguration

public class EurekaApplication {



    public static void main(String[] args) {

      SpringApplication.run(EurekaApplication.class,
    args);

    }


}
```

Add dependency to
spring-cloud-starter-eureka-server

spring X

HOME LAST 1000 SINCE STARTUP

System Status

Environment	
Data center	

Current time	2015-04-03T08:20:56 +0000
Uptime	00:04
Lease expiration enabled	true
Renews threshold	7
Renews (last min)	10

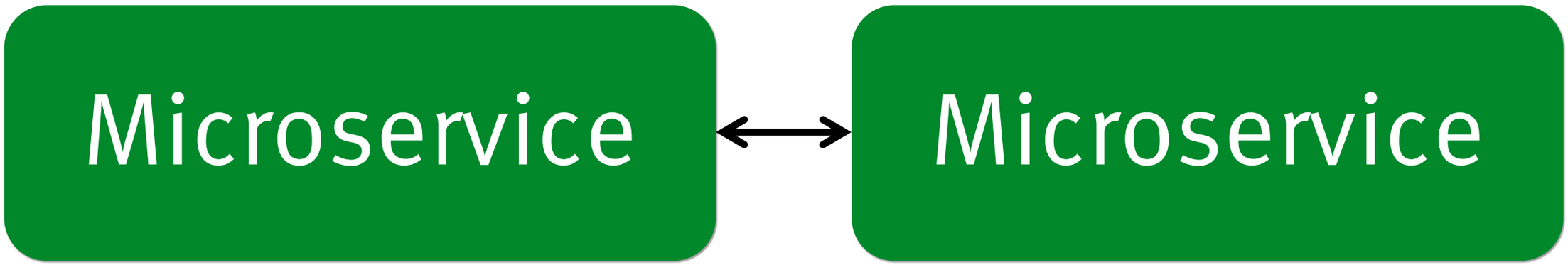
DS Replicas

localhost

Instances currently registered with Eureka

Application	AMIs	Availability Zones	Status
CATALOG	n/a (1)	(1)	UP (1) - 172.17.0.25:catalog:a5fb7f7dc1dfbb6cb83c55c198cbb637
CUSTOMER	n/a (1)	(1)	UP (1) - 172.17.0.24:customer:a0a7d00a563263391263ae9994720148
ORDER	n/a (1)	(1)	UP (1) - 172.17.0.26:order:903933c9d8fcd6d56578051df2e7ef4e
ZUUL	n/a (1)	(1)	UP (1) - 017f72e4c4a3

- Must find each other
- Route calls to a service



Zuul

Routing

Routing

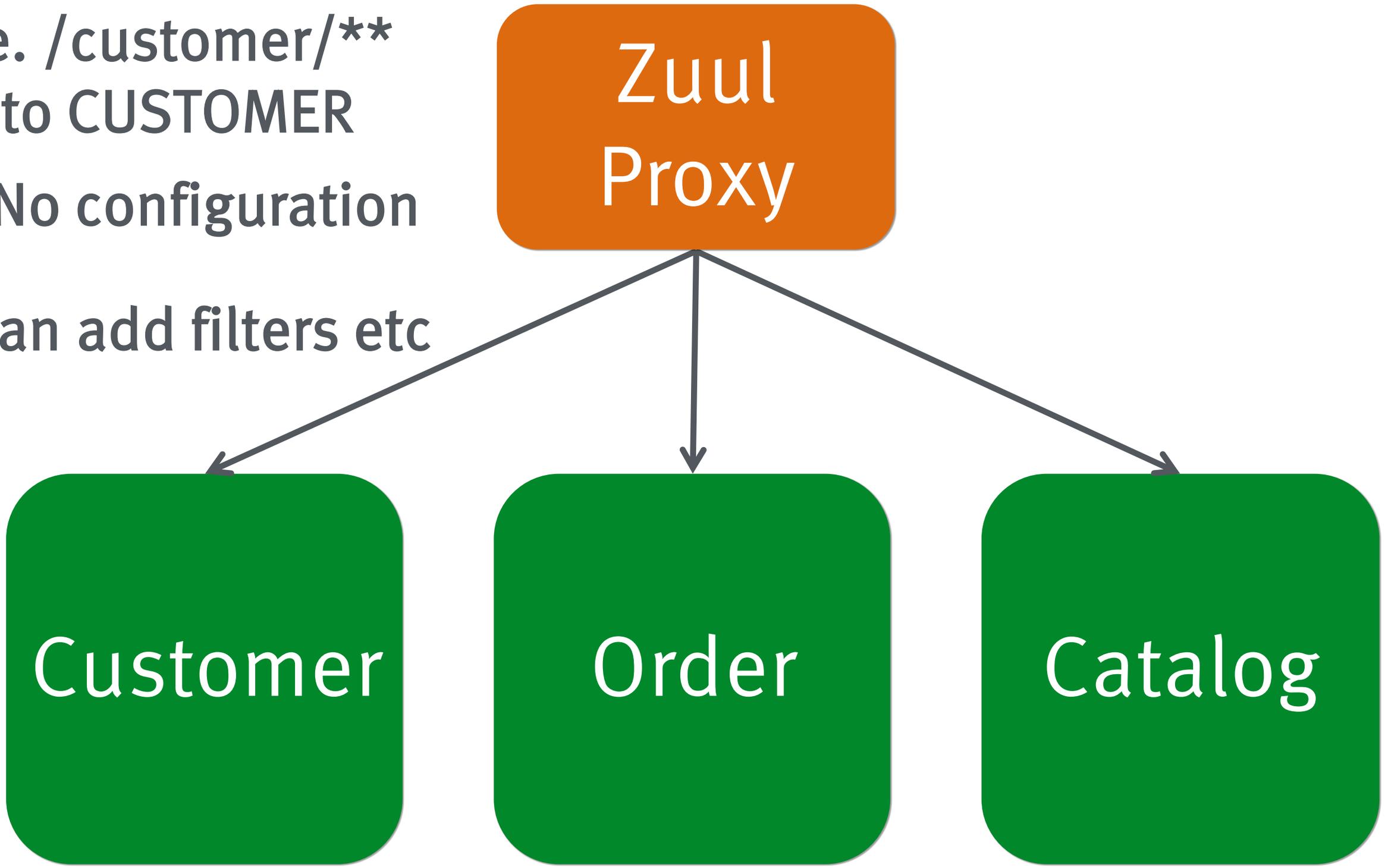
- One URL to the outside
- Internal: Many Microservices
- In particular: REST
- Power through filters

Automatically maps route to server registered on Eureka

i.e. /customer/**
to CUSTOMER

No configuration

Can add filters etc



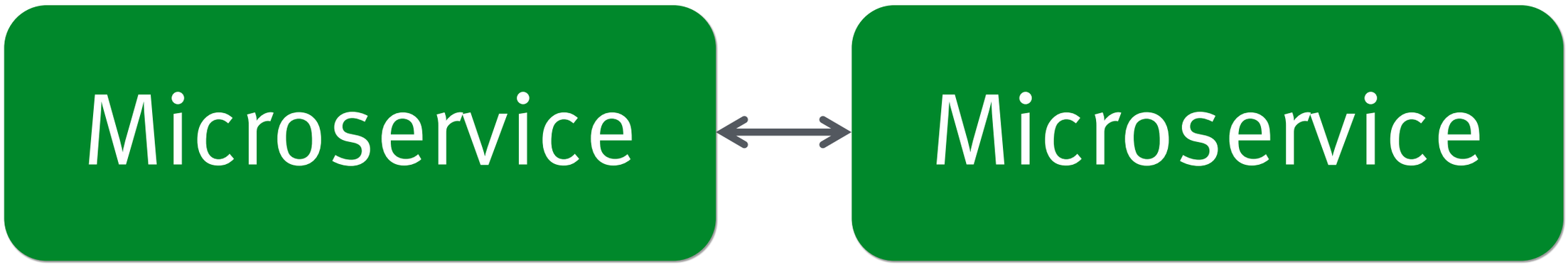
Zuul Proxy

```
@SpringBootApplication
@EnableZuulProxy
public class ZuulApplication {


    public static void main(String[] args) {
        new SpringApplicationBuilder(ZuulApplication.class).
         web(true).run(args);
    }


}
```

Enable Zuul Proxy

Can change route
Also routing to external services possible

- Must find each other
- Route calls to a service
- Configuration



Spring Cloud Config

Configuration

- Spring Cloud Config
- Central configuration
- Dynamic updates
- Can use git backend

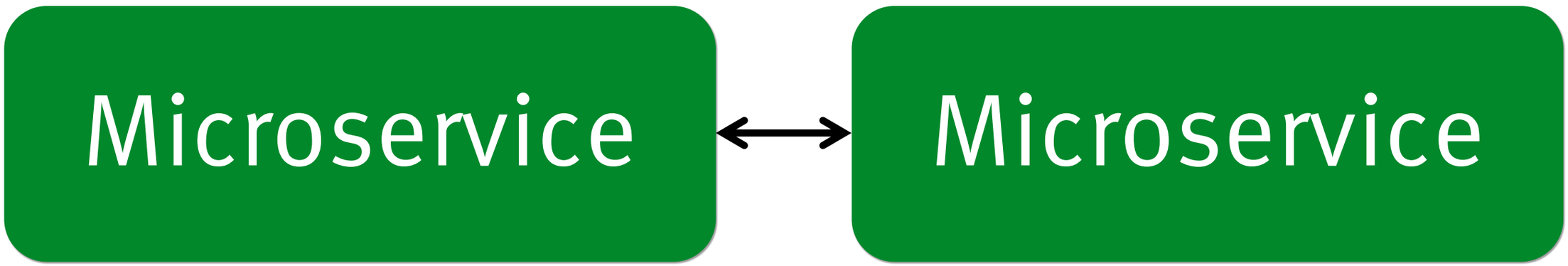
- I prefer immutable server
- & DevOps tools (Docker, Chef...)

Spring Cloud Bus

- Pushed config updates
- ...or individual message

- I prefer a messaging solution
- Independent from Spring

- Must find each other
- Route calls to a service
- Configuration
- Security



Spring Cloud Security

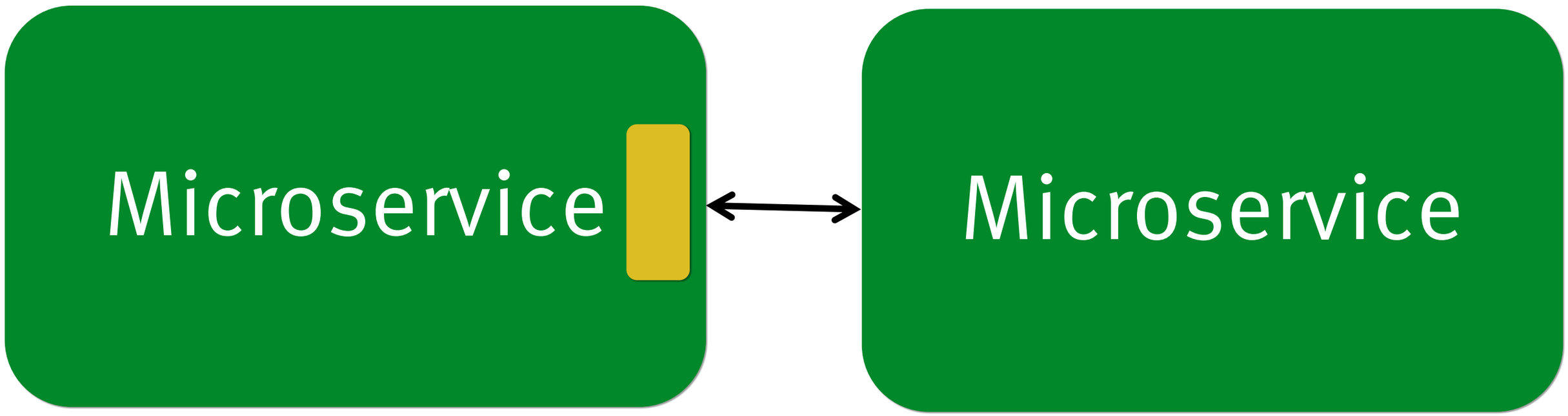
Spring Cloud Security

- Single Sign On via OAuth2
- Forward token e.g. via RestTemplate
- Support for Zuul

- Very valuable!

Implementing Microservices

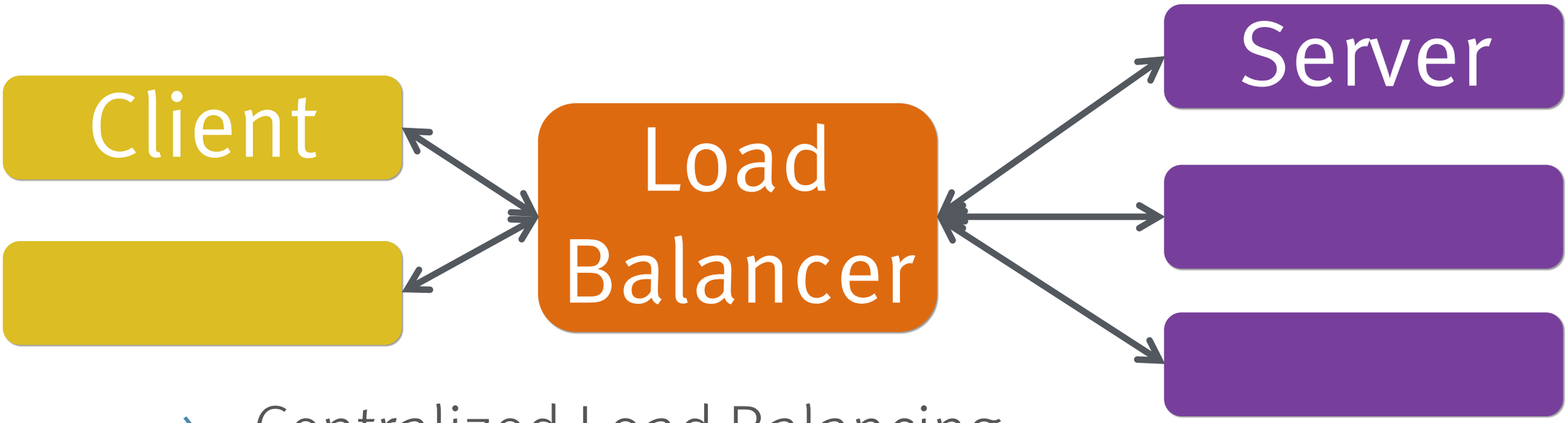
› Load Balancing



Load Balancing

Ribbon

Proxy Load Balancing



- Centralized Load Balancing
- Can become bottle neck
- Single point of failure
- Configuration complex

Ribbon: Client Side Load Balancing

- Decentralized Load Balancing
- No bottle neck
- Resilient
- Can consider response time
- Data might be inconsistent

RestTemplate & Load Balancing

Enable Ribbon

Left out other annotations

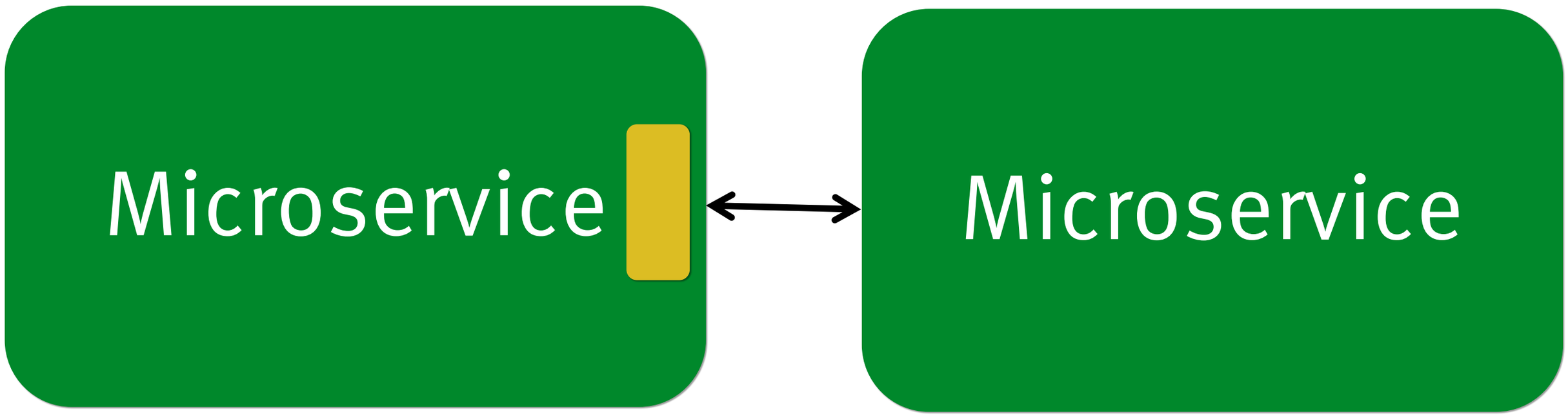
```
@RibbonClient(name = "ribbonApp")

…

public class RibbonApp {

   @Autowired

   private RestTemplate restTemplate;

   public void callMicroService() {

     Store store = restTemplate.


   getForObject("http://stores/store/1",
     Store.class);

   }

}
```

Standard Spring REST client

Can also use Ribbon API

Eureka name or server list

- Load Balancing
- Resilience



Hystrix

Resilience

Hystrix

- Enable resilient applications
- Do call in other thread pool
- Won’t block request handler
- Can implement timeout

Hystrix

- Circuit Breaker
- If call system fail open
- If open do not forward call
- Forward calls after a time window
- System won’t be swamped with requests

Hystrix / Spring Cloud

- Annotation based approach
- Annotations of javanica libraries
- Java Proxies automatically created

- Simplifies Hystrix dramatically
- No commands etc

Fallback

```
@HystrixCommand(fallbackMethod = "getItemsCache")
public Collection<Item> findAll() {
    …
    this.itemsCache = pagedResources.getContent();
    return itemsCache;
}

private Collection<Item> getItemsCache() {
    return itemsCache;
}
```

Hystrix Monitor

Eberhard

localhost:7979/hystrix/monitor?stream=http%3A%2F%

Stream via http

Hystrix Stream: http://localhost:8080/hystrix.stream

HYSTRIX
DEFEND YOUR APP

Circuit Sort: Error then Volume | Alphabetical | Volume | Error | Mean | Median | 90 | 99 | 99.5

Success | Short-Circuited | Timeout | Rejected | Failure | Error %

circuitBreaker

0 0 100.0 %
20 0
1

Host: 2.1/s
Cluster: 2.1/s
Circuit Open

Hosts	1	90th	0ms
Median	0ms	99th	0ms
Mean	0ms	99.5th	0ms

withFallback

0 0 0.0 %
0 0
0

Host: 0.0/s
Cluster: 0.0/s
Circuit Closed

Hosts	1	90th	0ms
Median	0ms	99th	0ms
Mean	0ms	99.5th	0ms

simple

0 0 0.0 %
0 0
0

Host: 0.0/s
Cluster: 0.0/s
Circuit Closed

Hosts	1	90th	1ms
Median	0ms	99th	1ms
Mean	0ms	99.5th	1ms

Thread Pools Sort: Alphabetical | Volume |

OtherMicroService

Host: 0.1/s
Cluster: 0.1/s

Active	0	Max Active	1
Queued	0	Executions	1
Pool Size	10	Queue Size	5

Circuit Breaker status

Thread Pool status

Conclusion

Infrastructure

- Easy to create a new project
- REST integrated
- Messaging supported
- Simple deployment
- Uniform operations

Spring Cloud

- Eureka: Service Discovery
- Zuul: Route calls to a service
- Spring Cloud Config: Configuration
- Ribbon: Load Balancing
- Hystrix: Resilience

Links

- https://github.com/ewolff/microservices
- https://github.com/ewolff/spring-boot-demos
- https://github.com/ewolff/user-registration-V2
- http://projects.spring.io/spring-boot/
- http://projects.spring.io/spring-cloud
- https://spring.io/guides/
- http://microservices-book.com

Thank You!!

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