Architecting for Continuous Delivery with Microservices

Session Two

Building and Composing Microservices

Building Twelve-Factor Apps with Spring Boot

The Twelve-Factor App

http://12factor.net

Introduction

In the modern era, software is commonly delivered as a service: called *web apps*, or *software-as-a-service*. The twelve-factor app is a methodology for building software-as-a-service apps that:

- Use **declarative** formats for setup automation, to minimize time and cost for new developers joining the project;
- Have a **clean contract** with the underlying operating system, offering **maximum portability** between execution environments;
- Are suitable for **deployment** on modern **cloud platforms**, obviating the need for servers and systems administration;
- **Minimize divergence** between development and production, enabling **continuous deployment** for maximum agility;
- And can **scale up** without significant changes to tooling, architecture, or development practices.

The twelve-factor methodology can be applied to apps written in any programming language, and which use any

Patterns

- Cloud-native application architectures
- Optimized for speed, safety, & scale
- Declarative configuration
- Stateless/shared-nothing processes
- Loose coupling to application environment

Twelve Factors (1/2)

- One Codebase in Version Control
- Explicit Dependencies
- Externalized Config
- Attached Backing Services
- Separate Build, Release, and Run Stages
- Stateless, Shared-Nothing Processes

Twelve Factors (2/2)

- Export Services via Port binding
- Scale Out Horizontally for Concurrency
- Instances Should Be Disposable
- Dev/Prod Parity
- Logs Are Event Streams
- Admin Processes

http://heroku.com

http://cloudfoundry.org

CLOUD FOUNDRY™

Microframeworks

- Dropwizard (http://www.dropwizard.io/)
- Spring Boot (http://projects.spring.io/spring-boot/)

Spring Boot

- http://projects.spring.io/spring-boot
- Opinionated convention over configuration
- Production-ready Spring applications
- Embed Tomcat, Jetty or Undertow
- *STARTERS*
- Actuator: Metrics, health checks, introspection

SPRING INITIALIZR

Bootstrap your application now

http://start.spring.io

Project metadata

Group

Artifact hello-spring-boot

Name hello-spring-boot

Description Twelve Factor Spring Boot Example

Package Name com.mattstine.twelvefactor.springboot

Type Maven Project

Project dependencies

Core

- [ ] Security
- [ ] AOP
- [ ] Atomikos (JTA)
- [ ] Bitronix (JTA)

Web

- [x] Web
- [ ] Websocket
- [ ] WS
- [ ] Jersey (JAX-RS)
- [ ] Rest Repositories
- [ ] HATEOAS
- [ ] Mobile

Template Engines

Data

Writing a Single Service is Nice....


But No Microservice
is an Island

Challenges of Distributed Systems

- Configuration Management
- Service Registration & Discovery
- Routing & Load Balancing
- Fault Tolerance (Circuit Breakers!)
- Monitoring


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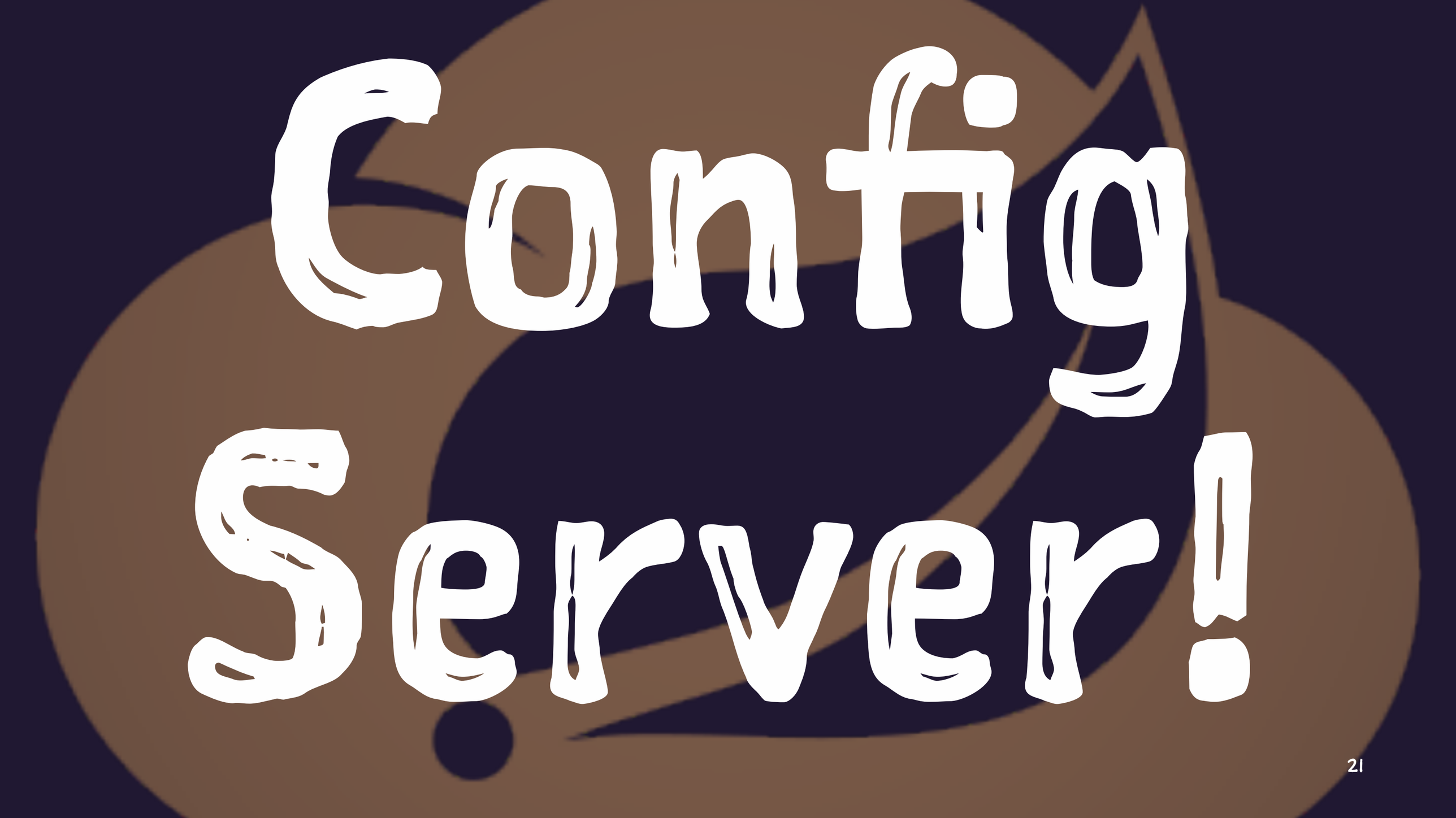
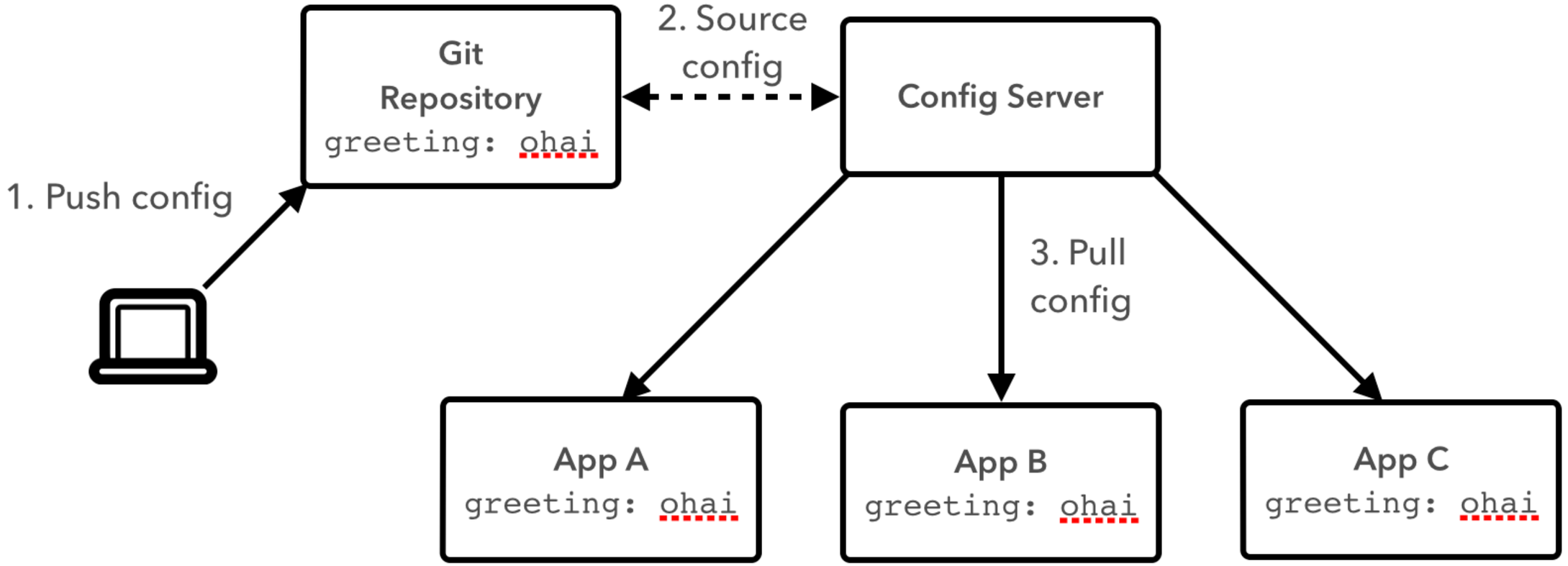
Spring Cloud

Distributed System Patterns FTW!

Configuration Management

Distributed?


Config
Server!


Git
Repository
greeting: ohai
2. Source
config
Config Server
1. Push config
3. Pull
config
App A
greeting: ohai
App B
greeting: ohai
App C
greeting: ohai

Config Server app.groovy

```
@Grab("org.springframework.cloud:spring-cloud-starter-bus-amqp:1.0.0.RC1")
@EnableConfigServer
class ConfigServer {
}
```

Config Server application.yml

```
server:
  port: 8888

spring:
  cloud:
    config:
      server:
        git:
          uri: https://github.com/mstine/config-repo.git
```

https://github.com/mstine/config-repo/blob/master/demo.yml

```
greeting: Bonjour
```

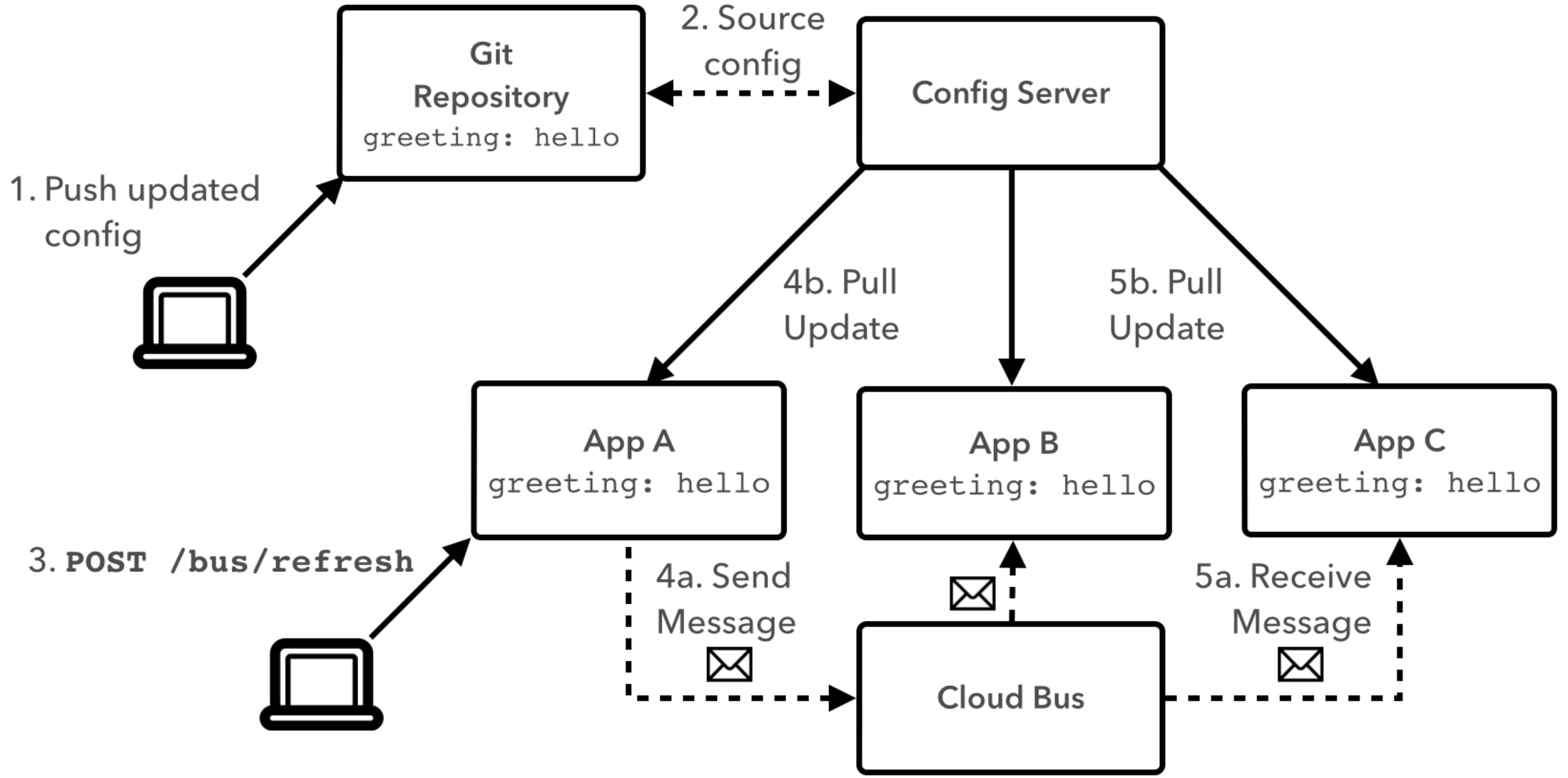
Config Client app.groovy

```
@Grab("org.springframework.cloud:spring-cloud-starter-bus-amqp:1.0.0.RC1")
@RestController
class BasicConfig {

  @Autowired
  Greeter greeter

  @RequestMapping("/")
  String home() {
    "${greeter.greeting} World!"
  }
}

@Component
@RefreshScope
class Greeter {

  @Value('${greeting}')
  String greeting

}
```

Config Client bootstrap.yml

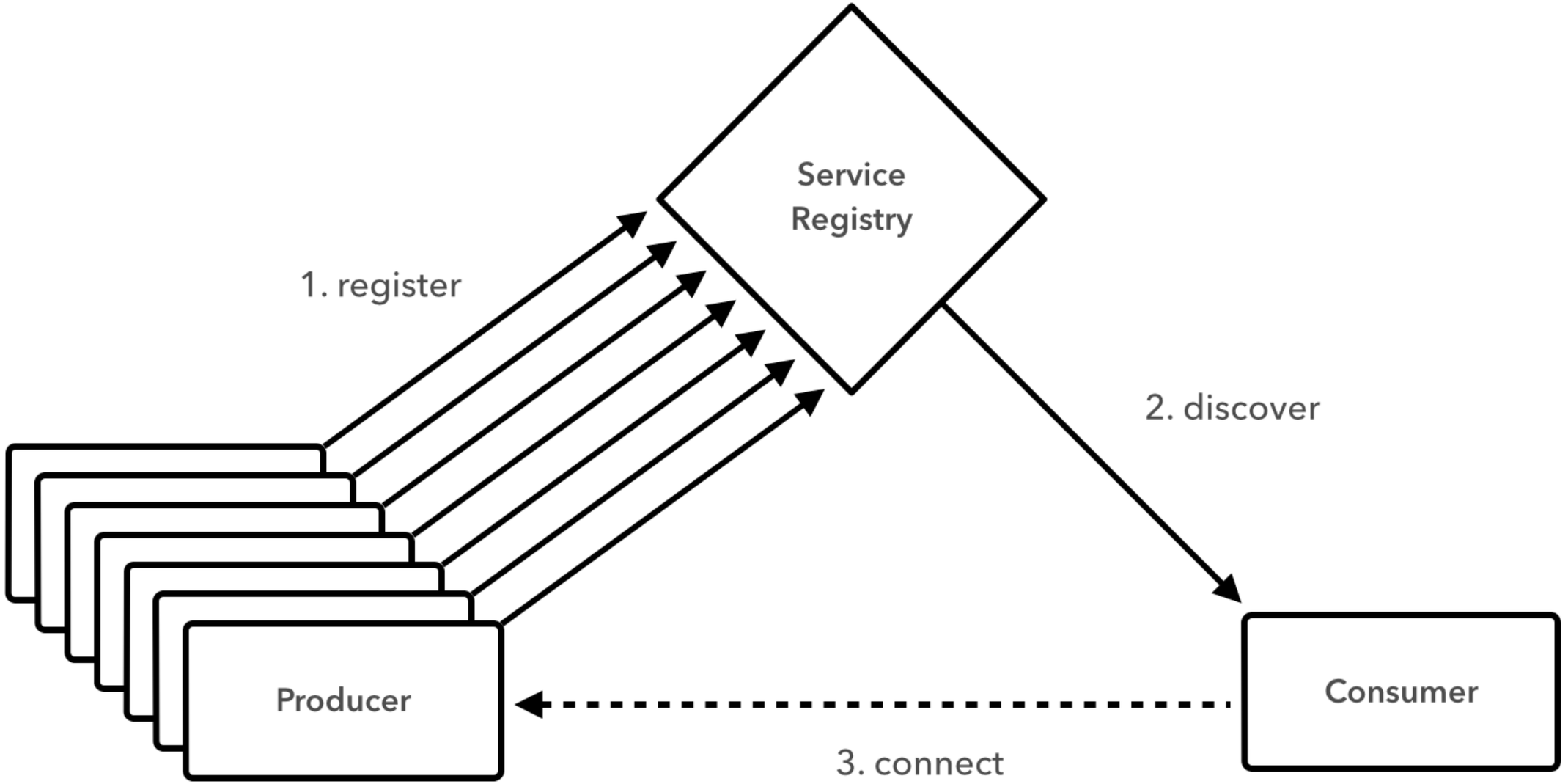
```
spring:
  application:
    name: demo
```

Cloud Bus!


Git
Repository
greeting: hello
2. Source
config
Config Server
1. Push updated
config
4b. Pull
Update
5b. Pull
Update
App A
greeting: hello
App B
greeting: hello
App C
greeting: hello
3. POST /bus/refresh
4a. Send
Message
5a. Receive
Message
Cloud Bus

```
curl -X POST http://localhost:8080/bus/refresh
```

Service Registration & Discovery


Service
Registry
1. register
2. discover
Producer
Consumer
3. connect

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Eureka

Producer Consumer

Eureka Service Registry

```
@GrabExclude("ch.qos.logback:logback-classic")
@EnableEurekaServer
class Eureka {
}
```

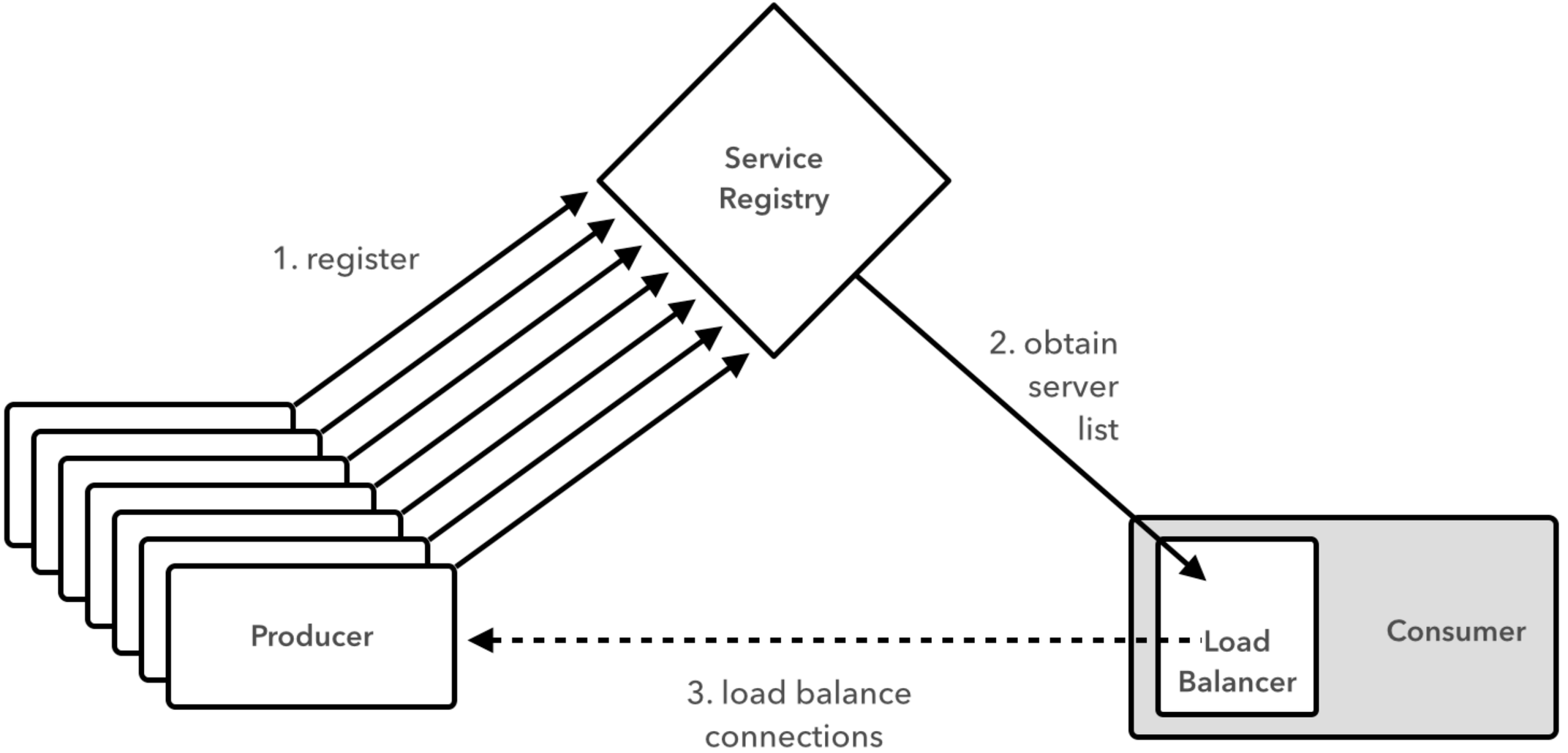
Producer

```
@EnableDiscoveryClient
@RestController
public class Application {

  int counter = 0

  @RequestMapping("/")
  String produce() {
    "{\"value\": ${counter++}}"
  }
}
```

Consumer

```
@EnableDiscoveryClient
@RestController
public class Application {

  @Autowired
  DiscoveryClient discoveryClient

  @RequestMapping("/")
  String consume() {
    InstanceInfo instance = discoveryClient.getNextServerFromEureka("PRODUCER", false)

    RestTemplate restTemplate = new RestTemplate()
    ProducerResponse response = restTemplate.getForObject(instance.homePageUrl, ProducerResponse.class)

    "{\"value\": ${response.value}}"
  }
}

public class ProducerResponse {
  Integer value
}
```

Routing & Load Balancing


Service
Registry
1. register
2. obtain
server
list
Producer
Load
Balancer
Consumer
3. load balance
connections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Consumer with Load Balancer

```
@Autowired
LoadBalancerClient loadBalancer

@RequestMapping("/")
String consume() {
  ServiceInstance instance = loadBalancer.choose("producer")
  URI producerUri = URI.create("http://${instance.host}:${instance.port}");

  RestTemplate restTemplate = new RestTemplate()
  ProducerResponse response = restTemplate.getForObject(producerUri, ProducerResponse.class)

  "{\"value\": ${response.value}}"
}
```

Consumer with Ribbon-enabled RestTemplate

```
@Autowired
RestTemplate restTemplate

@RequestMapping("/")
String consume() {
  ProducerResponse response = restTemplate.getForObject("http://producer", ProducerResponse.class)

  "{\"value\": ${response.value}}"
}
```

Feign Client

```
@FeignClient("producer")
public interface ProducerClient {

  @RequestMapping(method = RequestMethod.GET, value = "/")
  ProducerResponse getValue();
}
```

Consumer with Feign Client

```
@SpringBootApplication
@EnableFeignClients
@EnableDiscoveryClient
@RestController
public class Application {

  @Autowired
  ProducerClient client;

  @RequestMapping("/")
  String consume() {
    ProducerResponse response = client.getValue();

    return "{\"value\": " + response.getValue() + "}";
  }

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

Fault Tolerance

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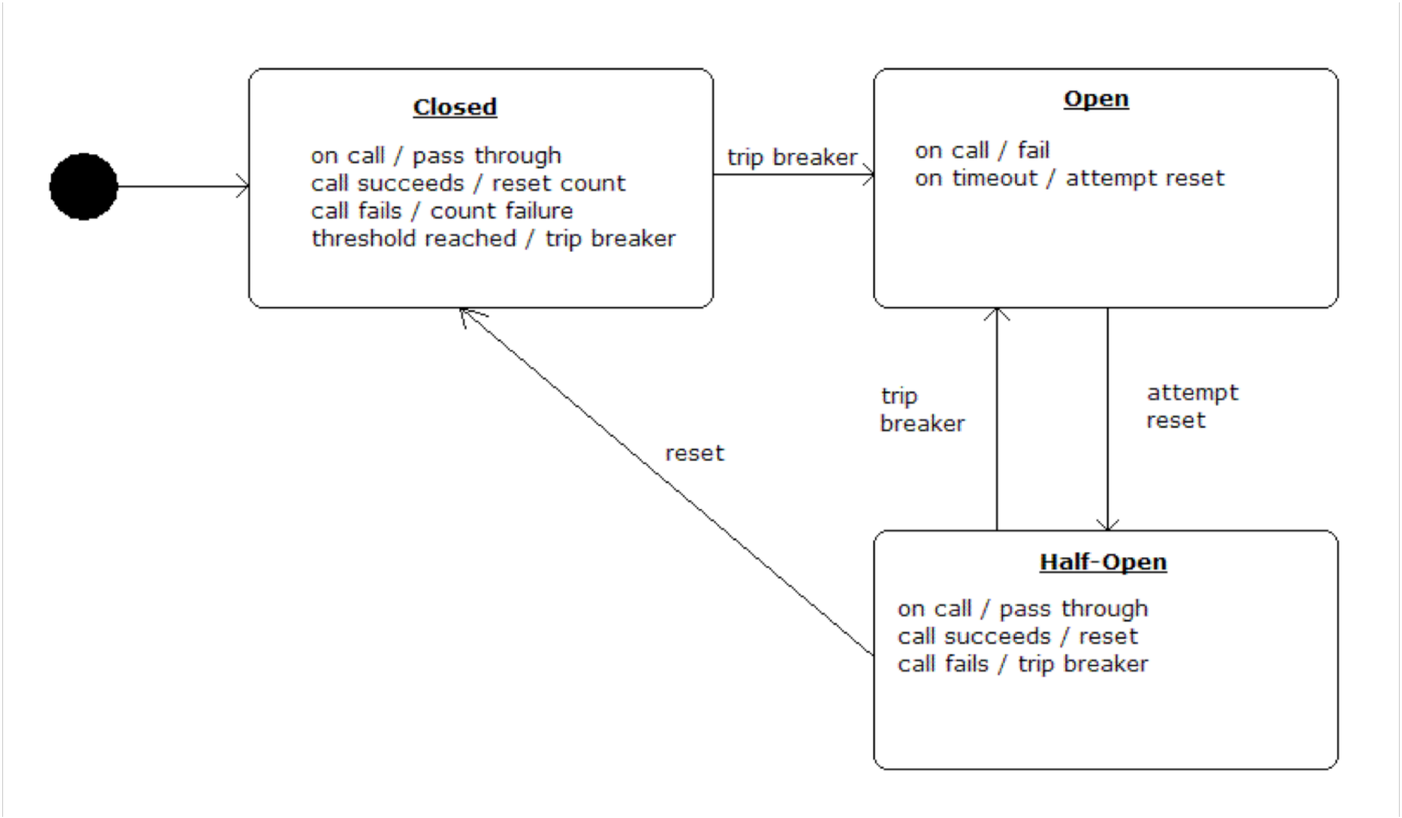
Hystrix

Circuit Breaker



Consumer app.groovy

```
@EnableDiscoveryClient
@EnableCircuitBreaker
@RestController
public class Application {

  @Autowired
  ProducerClient client

  @RequestMapping("/")
  String consume() {
    ProducerResponse response = client.getProducerResponse()

    "{\"value\": ${response.value}}"
  }

}
```

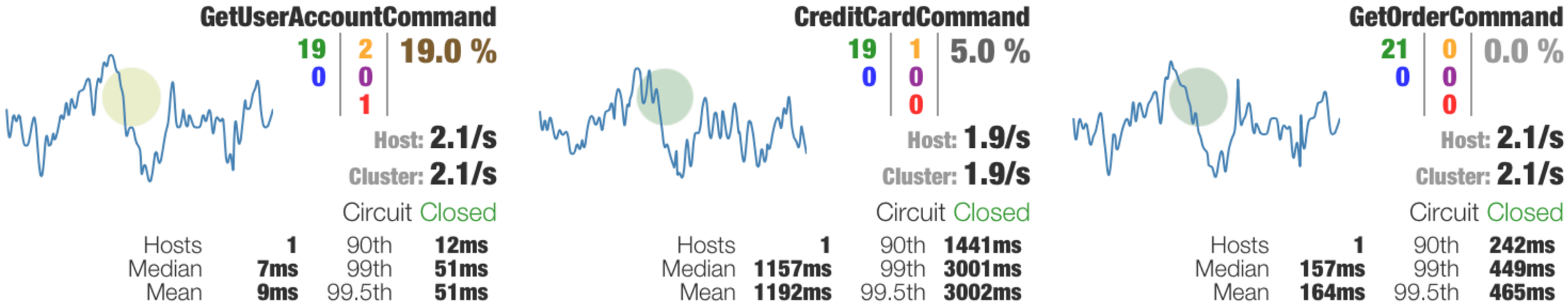
Producer Client

```
@Component
public class ProducerClient {

  @Autowired
  RestTemplate restTemplate

  @HystrixCommand(fallbackMethod = "getProducerFallback")
  ProducerResponse getProducerResponse() {
    restTemplate.getForObject("http://producer", ProducerResponse.class)
  }

  ProducerResponse getProducerFallback() {
    new ProducerResponse(value: 42)
  }
}
```

Monitoring

Hystrix Dashboard

Hystrix Dashboard



Hystrix Dashboard

```
@Grab("org.springframework.cloud:spring-cloud-starter-hystrix-dashboard:1.0.0.RC1")

import org.springframework.cloud.netflix.hystrix.dashboard.EnableHystrixDashboard

@EnableHystrixDashboard
class HystrixDashboard {
}
```

TO THE LABS!