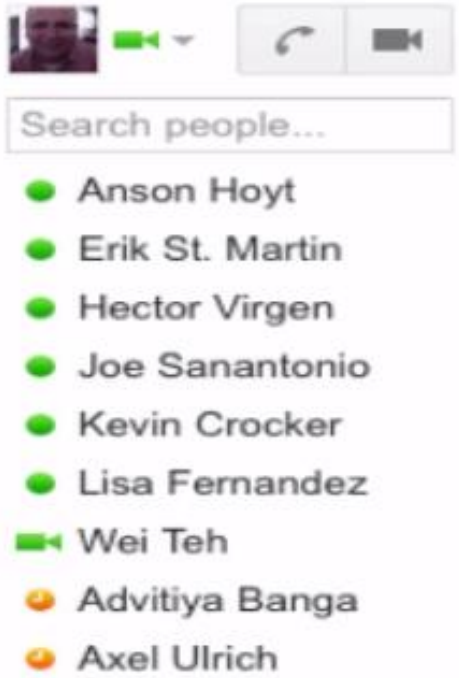
Objectives

- At the end of this module, you will be able to
  - Explain what Passive Service Discovery is
  - Build and Run and Spring Cloud Eureka Server
  - Build, Run, and Configure a Eureka Client

Service Discovery - Analogy

- When you sign into a chat client, what happens?
  - Client 'registers' itself with the server – server knows you are online.
  - The server provides you with a list of all the other known clients
- In essence, you client has “discovered” the other clients
  - ...and has itself been “discovered” by others



Service Discovery

- Microservice architectures result in large numbers of inter-service calls
  - Very challenging to configure
- How can one application easily find all of the other runtime dependencies?
  - Manual configuration – Impractical, brittle
- Service Discovery provides a single 'lookup' service.
  - Clients register themselves, discover other registrants.
  - Solutions: Eureka, Consul, Etcd, Zookeeper, SmartStack, etc.

Eureka –
Service Discovery Server and Client

- Part of Spring Cloud Netflix
  - Battle tested by Netflix
- Eureka provides a 'lookup' server.
  - Generally made highly available by running multiple copies
  - Copies replicate state of registered services.
- “Client” Services register with Eureka
  - Provide metadata on host, port, health indicator URL, etc.
- Client Services send heartbeats to Eureka
  - Eureka removes services without heartbeats.

Multiple Servers
Configuration

- Common Configuration Options for Eureka Server:
  - See https://github.com/Netflix/eureka/wiki/Configuring-Eureka for full list.

Control http port (any boot application)

```
server:
  port: 8011
eureka:
  instance:
    statusPageUrlPath: ${management.contextPath}/info
    healthCheckUrlPath: ${management.contextPath}/health
    hostname: localhost
  client:
    registerWithEureka: false
    fetchRegistry: false
    serviceUrl:
      defaultZone: http://server:port/eureka/,http://server:port/eureka/
```

Comma separated list

Module Outline

- Service Discovery
- Eureka Server
- **Discovery Client**
- Service Discovery Considerations

Spring Cloud Ribbon

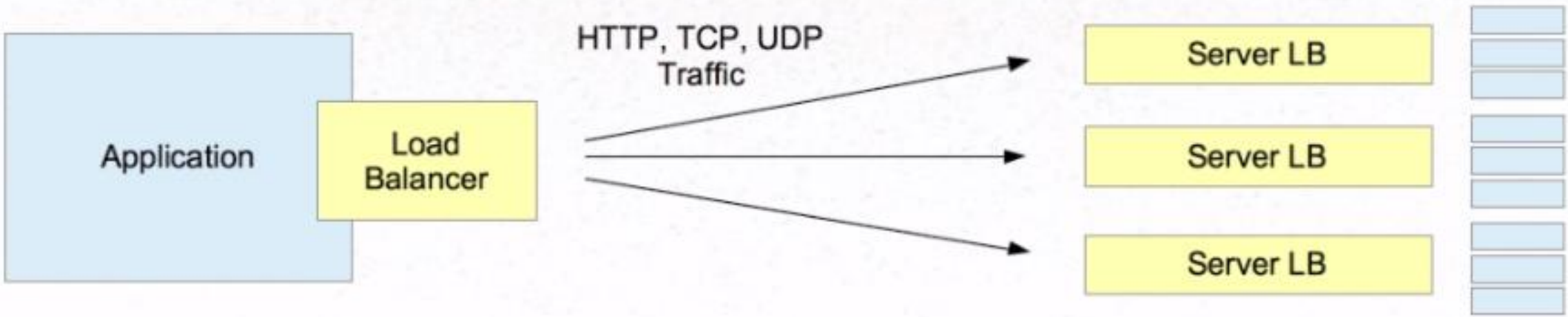
Understanding and Using Ribbon,
The client side load balancer

What is a Load Balancer?

- Traditional load balancers are server-side components
  - Distribute incoming traffic among several servers
  - Software (Apache, Nginx, HA Proxy) or Hardware (F5, NSX, BigIP)

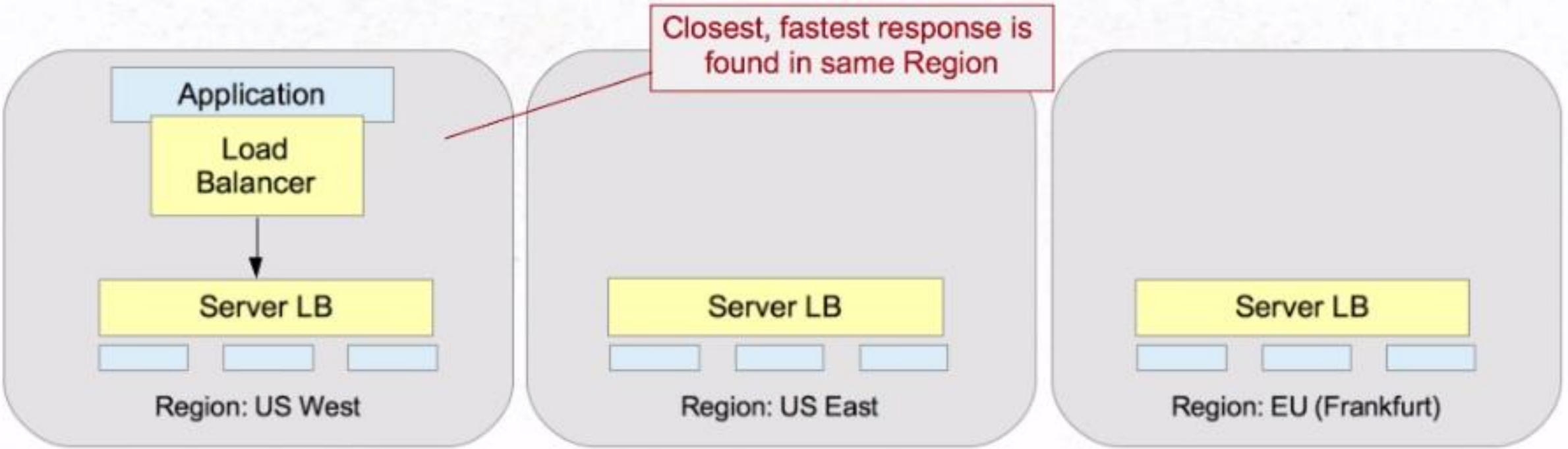
Client-Side Load Balancer

- Client-Side Load Balancer selects which server to call
  - Based on some criteria
  - Part of client software
  - Server can still employ its own load balancer



Why?

- Not all servers are the same
  - Some may be unavailable (faults)
  - Some may be slower than others (performance)
  - Some may be further away than others (regions)



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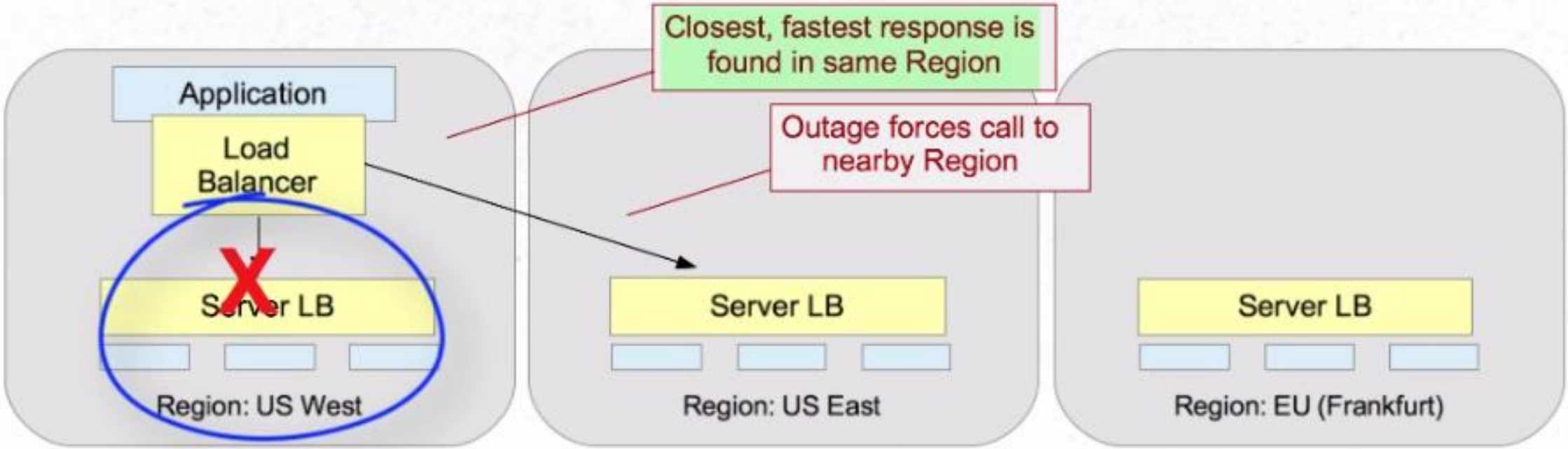


Module Outline

- Client Side Load Balancing
- **Spring Cloud Netflix Ribbon**

Spring Cloud Netflix Ribbon

- Ribbon – Another part of the Netflix OSS family
  - Client side load balancer
  - Automatically integrates with service discovery (Eureka)
  - Built in failure resiliency (Hystrix)
  - Caching / Batching
  - Multiple protocols (HTTP, TCP, UDP)
- Spring Cloud provides an easy API Wrapper for using Ribbon.

Key Ribbon Concepts

- List of Servers
- Filtered List of Servers
- Load Balancer
- Ping

List of Servers

- Determines what the list of possible servers are (for a given service (client))
  - Static – Populated via configuration
  - Dynamic – Populated via Service Discovery (Eureka)
- Spring Cloud default – Use Eureka when present on the classpath.

Example of "Static" server lists

"stores" and "products" - Examples of client-ids

application.yml

```
stores:
  ribbon:
    listOfServers: store1.com,store2.com
products:
  ribbon:
    listOfServers: productServer1.com, productServer2.com
```

Filtered List of Servers

- Criteria by which you wish to limit the total list
- Spring Cloud default – Filter servers in the same *zone*

Ping

- Used to test if the server is up or down
- Spring Cloud default – delegate to Eureka to determine if server is up or down

Load Balancer

- The Load Balancer is the actual component that routes the calls to the servers in the filtered list
- Several strategies available, but they usually defer to a Rule component to make the actual decisions
- Spring Cloud's Default: ZoneAwareLoadBalancer

Rule

- The Rule is the single module of intelligence that makes the decisions on whether to call or not.
- Spring Cloud's Default: ZoneAvoidanceRule

Using Ribbon with Spring Cloud – part 1

- Use the Spring Cloud Starter parent as a Parent POM:

```
<parent>
   <groupId>org.springframework.cloud</groupId>
   <artifactId>spring-cloud-starter-parent</artifactId>
   <version>Angel.SR4</version>
</parent>
```

- ...OR use a Dependency management section:

```
<dependencyManagement>
   <dependencies>
      <dependency>
         <groupId>org.springframework.cloud</groupId>
         <artifactId>spring-cloud-starter-parent</artifactId>
         <version>Angel.SR4</version>
         <type>pom</type>
         <scope>import</scope>
      </dependency>
   </dependencies>
</dependencyManagement>
```

...exactly the same options as a spring cloud config client or a spring cloud eureka client.

Using Ribbon with Spring Cloud – part 2

- Include dependency:

```
<dependencies>
  <dependency>
    <groupId>org.springframework.cloud</groupId>
    <artifactId>spring-cloud-starter-ribbon</artifactId>
  </dependency>
</dependencies>
```

Using Ribbon with Spring Cloud – part 3

- Low-level technique:
  - Access LoadBalancer, use directly:

```
public class MyClass {
    @Autowired LoadBalancerClient loadBalancer;

    public void doStuff() {
        ServiceInstance instance = loadBalancer.choose("subject");
        URI subjectUri = URI.create(String.format("http://%s:%s",
            instance.getHost(), instance.getPort()));
        // ... do something with the URI
    }
}
```

"subject" - An example of a "client-id"

Instance selected by the load balancer

API Reference

- Previous example used Ribbon API directly
  - Not desirable – couples code to Ribbon
- Upcoming examples will show declarative approach
  - Feign, Hystrix.

Customizing

- Previously we described the defaults. What if you want to change them?
- Declare a separate config with replacement bean.

```
@Configuration
@RibbonClient(name="subject", configuration=SubjectConfig.class)
public class MainConfig {
}
```

```
@Configuration
public class SubjectConfig {
    @Bean
    public IPing ribbonPing(IClientConfig config) {
        return new PingUrl();
    }
}
```

Replaces the "Ping" strategy
Employed when calling "subject" clients

Note: Do NOT component scan SubjectConfig!

Summary

- Client-Side Load Balancing augments regular load balancing by allowing the client to select a server based on some criteria.
- Spring Cloud Ribbon is an easy-to-use implementation of client side load balancing.

Spring Cloud Feign

Declarative REST Client

Objectives

- At the end of this module, you will be able to
  - Call REST services using the Feign libraries
  - Understand how Feign, Ribbon, and Eureka collaborate

Module Outline

- What is Feign
- How to use Feign

Feign

- What is it?
  - Declarative REST client, from NetFlix
  - Allows you to write calls to REST services with no implementation code
  - Alternative to RestTemplate (even easier!)
  - Spring Cloud provides easy wrapper for using Feign

Spring REST Template

- Spring's Rest Template provides very easy way to call REST services

```
RestTemplate template = new RestTemplate();
String url = "http://inventoryService/{0}";
Sku sku = template.getForObject(url,  Sku.class, 4724352);
```

Instantiate
(or dependency inject)

Provide target URL
(note the placeholder)

Call the URL, provide expected class,
Provide value for placeholder.
Template takes care of all HTTP
and type conversion!

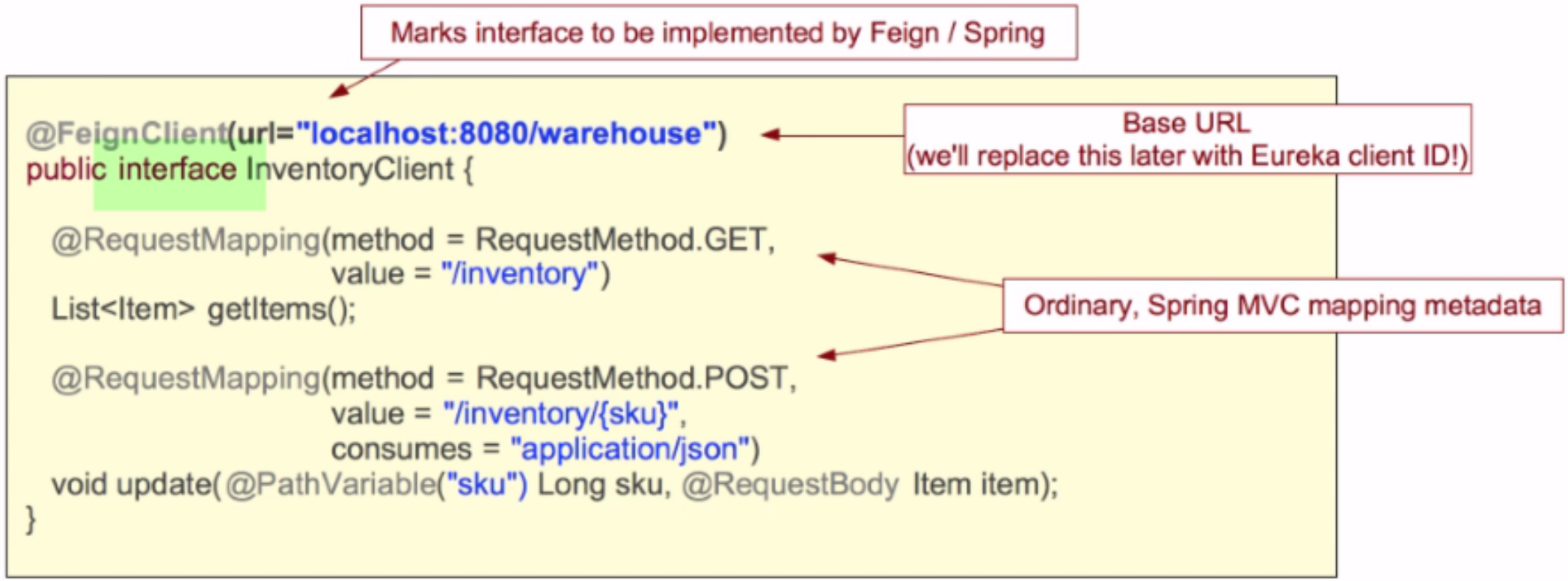
- Still, this code must be
  1) Written
  2) Unit-tested with mocks / stubs.

Feign Alternative –
Declarative Web Service Clients

- How does it work?
  - Define *interfaces* for your REST client code
  - Annotate interface with Feign annotation
  - Annotate methods with Spring MVC annotations
    - Other implementations like JAX/RS pluggable
- Spring Cloud will implement it at run-time
  - Scans for interfaces
  - Automatically implements code to call REST service and process response

Feign Interface

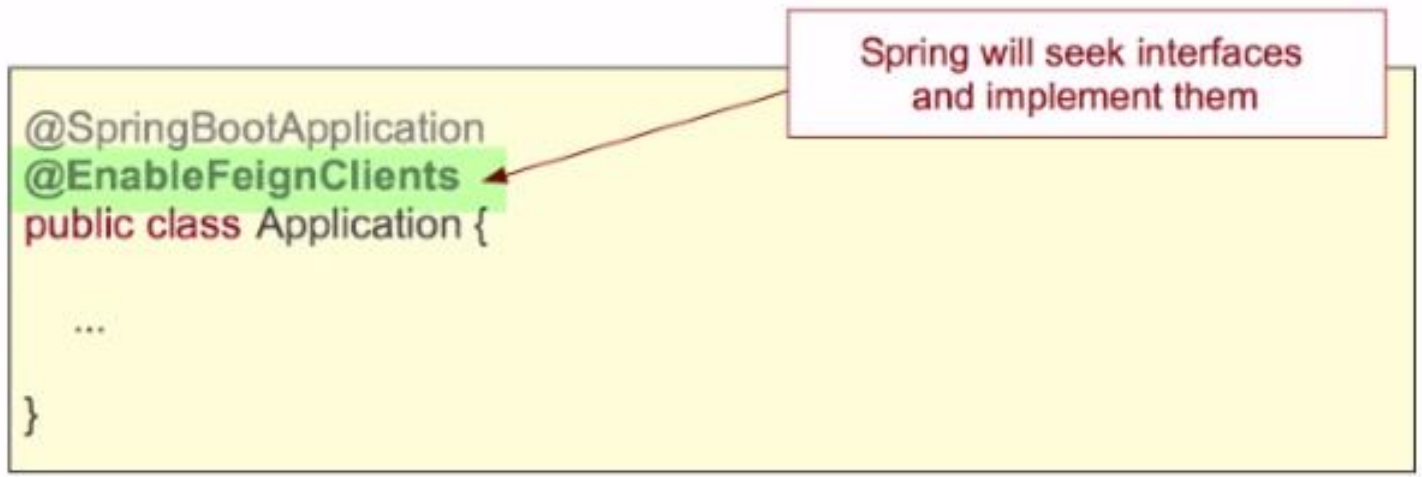
- Create an *Interface*, not a Class:



Note: No extra dependencies are needed for Feign when using Spring Cloud.

Runtime Implementations

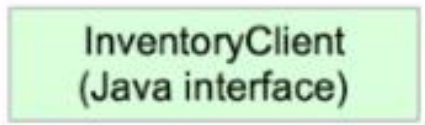
- Spring scans for @FeignClients
  - Provides implementations at runtime



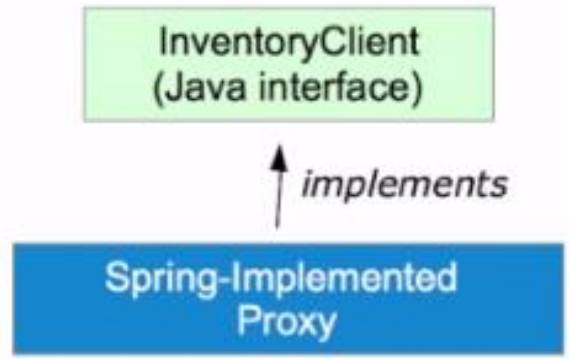
- That's it!
  - Implementations provided by Spring / Feign!

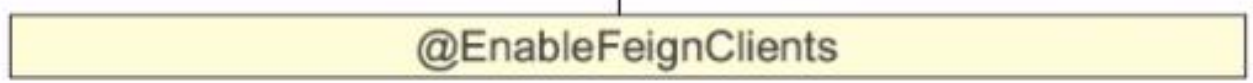
What does @EnableFeignClients do?

- Before startup



- After startup





You can @Autowire an InventoryClient wherever one is needed

Ribbon and Eureka

Where do they fit in?

- The previous example - hard-coded URL:

```
@FeignClient(url="localhost:8080/warehouse")
```

- ...use a Eureka “Client ID” instead:

```
@FeignClient("warehouse")
```

- Ribbon is automatically enabled
  - Eureka gives our application all “Clients” that match the given Client ID
  - Ribbon automatically applies load balancing
  - Feign handles the code.

Runtime Dependency

- Feign starter required at runtime:

  ...but not compile time

```
<dependencies>
  <dependency>
    <groupId>org.springframework.cloud</groupId>
    <artifactId>spring-cloud-starter-feign</artifactId>
  </dependency>
</dependencies>
```

Spring Cloud Hystrix

Understanding and Applying
Client Side Circuit Breakers