



Java Framework Day 1





Somkiat Puisungnoen

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Public Post

Intro

Software Craftsmanship

Software Practitioner at สยามชั่นนาฎกิจ พ.ศ. 2556

Agile Practitioner and Technical at SPRINT3r

Somkiat Puisungnoen 15 mins · Bangkok · ...

Java and Bigdata



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Agenda

- RESTful API
- Java frameworks
- Building RESTful API with Spring Boot
- Spring Boot with Spring Data (JDBC/JPA)
- Spring Boot with Spring Data (MongoDB)
- Testing with Spring Boot
- Q/A



REST



REST

REpresentation **S**tate **T**ransfer

The style of software architecture behind
RESTful services

Defined in 2000 by Roy Fielding

https://www.ics.uci.edu/~fielding/pubs/dissertation/rest_arch_style.htm



Goals

Scalability
Generality of interfaces
Independent deployment of components



RESTful service



REST Request Messages

RESTful request is typically in form of
Uniform Resource Identifiers (URI)



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Uniform Resource Identifiers (URI)

Structure of URI depend on specific service



REST Request Messages

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Uniform Resource Identifiers (URI)

Structure of URI depend on specific service

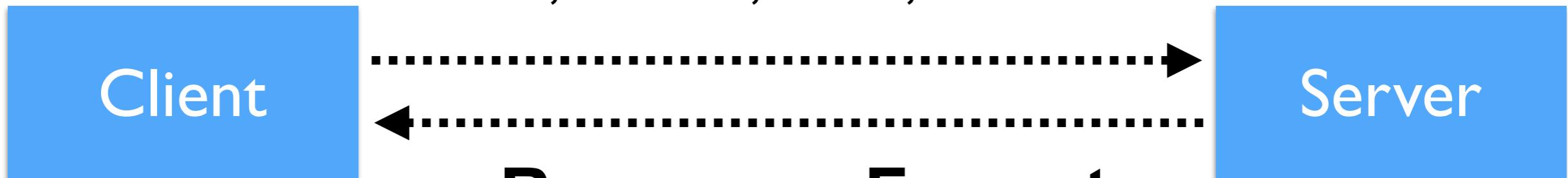
Request can include parameter and data in
body of request as XML, JSON etc.



REST Request & Response

Request Method

GET, POST, PUT, DELETE



Response Format

XML or JSON



HTTP Methods meaning

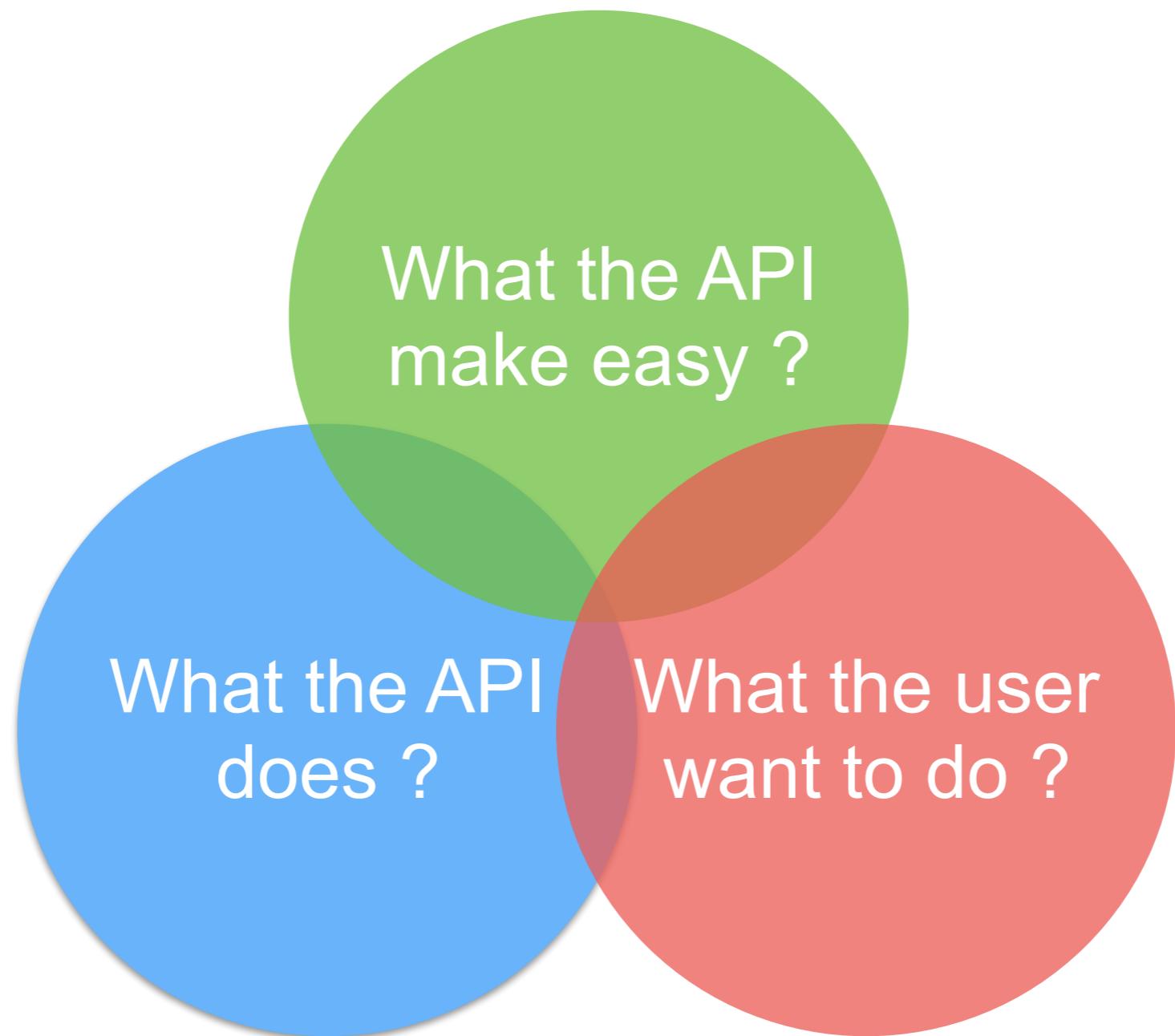
Method	Meaning
GET	Read data
POST	Create/Insert new data
PUT/PATCH	Update data or insert if a new id
DELETE	Delete data



Response format ?



Good APIs ?



Java Framework for RESTful



unirest

Lightweight HTTP Request Client Libraries



Spark



Restlet



Dropwizard



ACT.framework

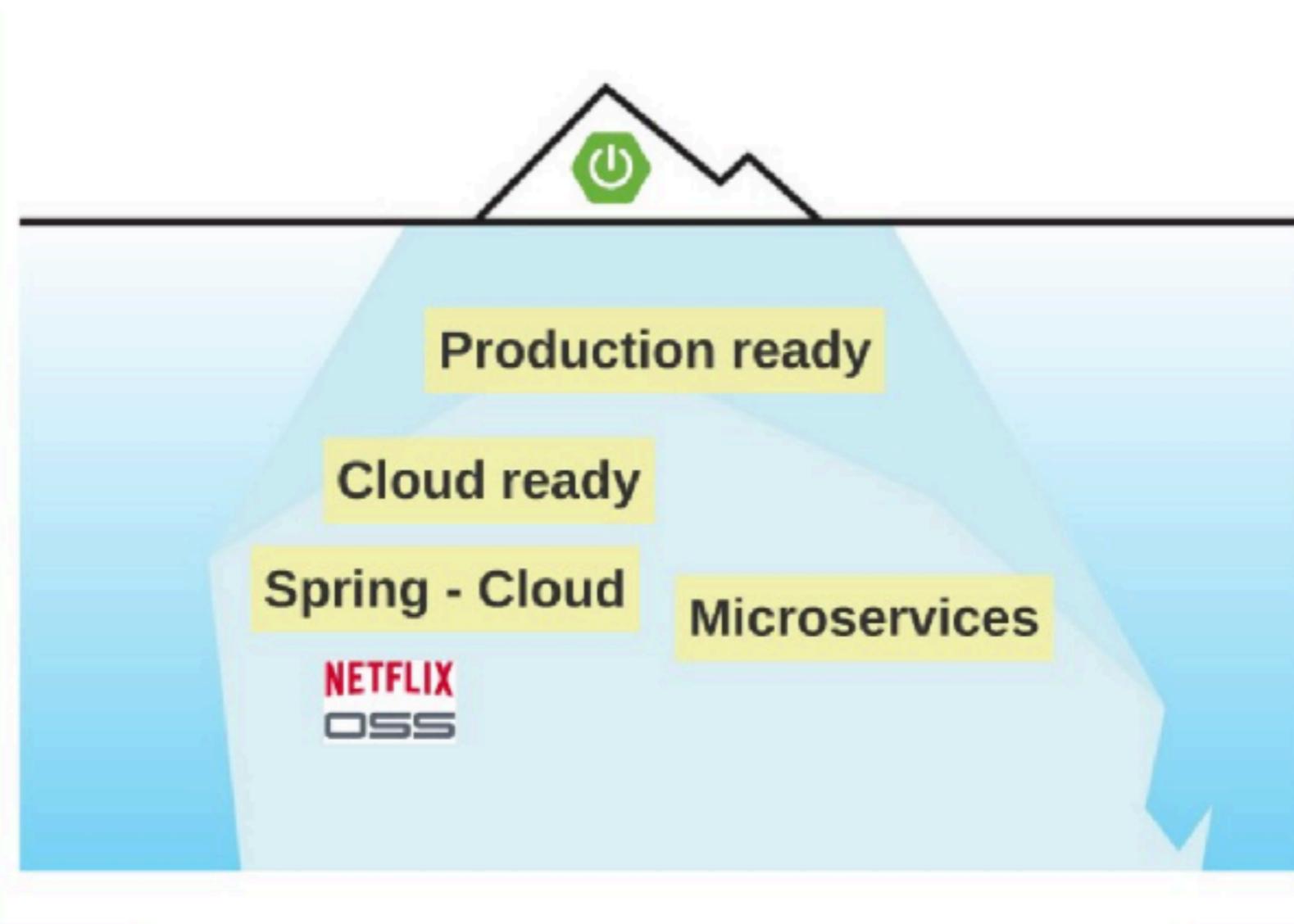


Hello Spring Boot 2.x



Why ?

Application skeleton generator
Reduce effort to add new technologies



What ?

Embedded application server

Integration with tools/technologies (starter)

Production tools (monitoring, health check)

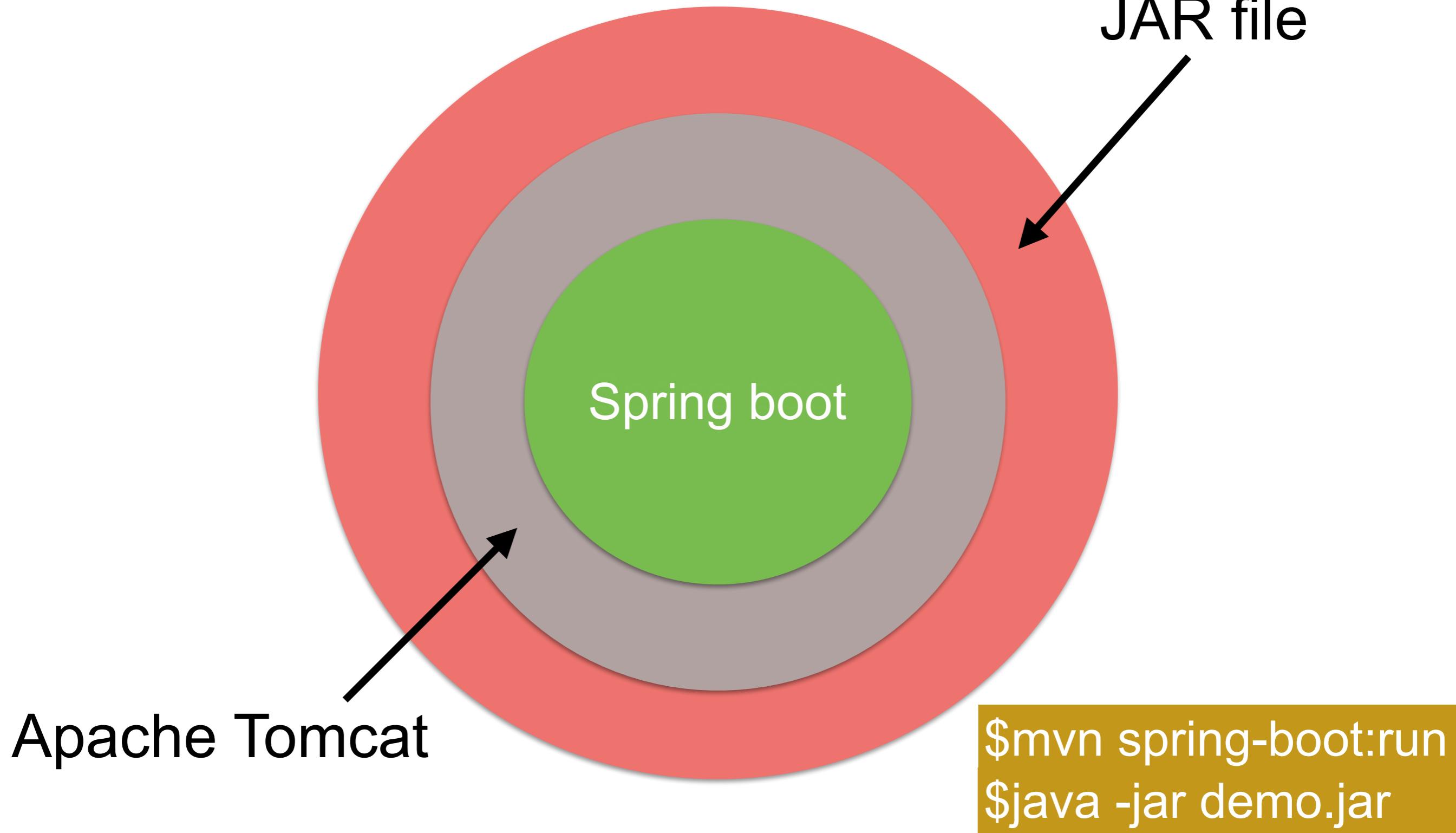
Configuration management

Dev tools

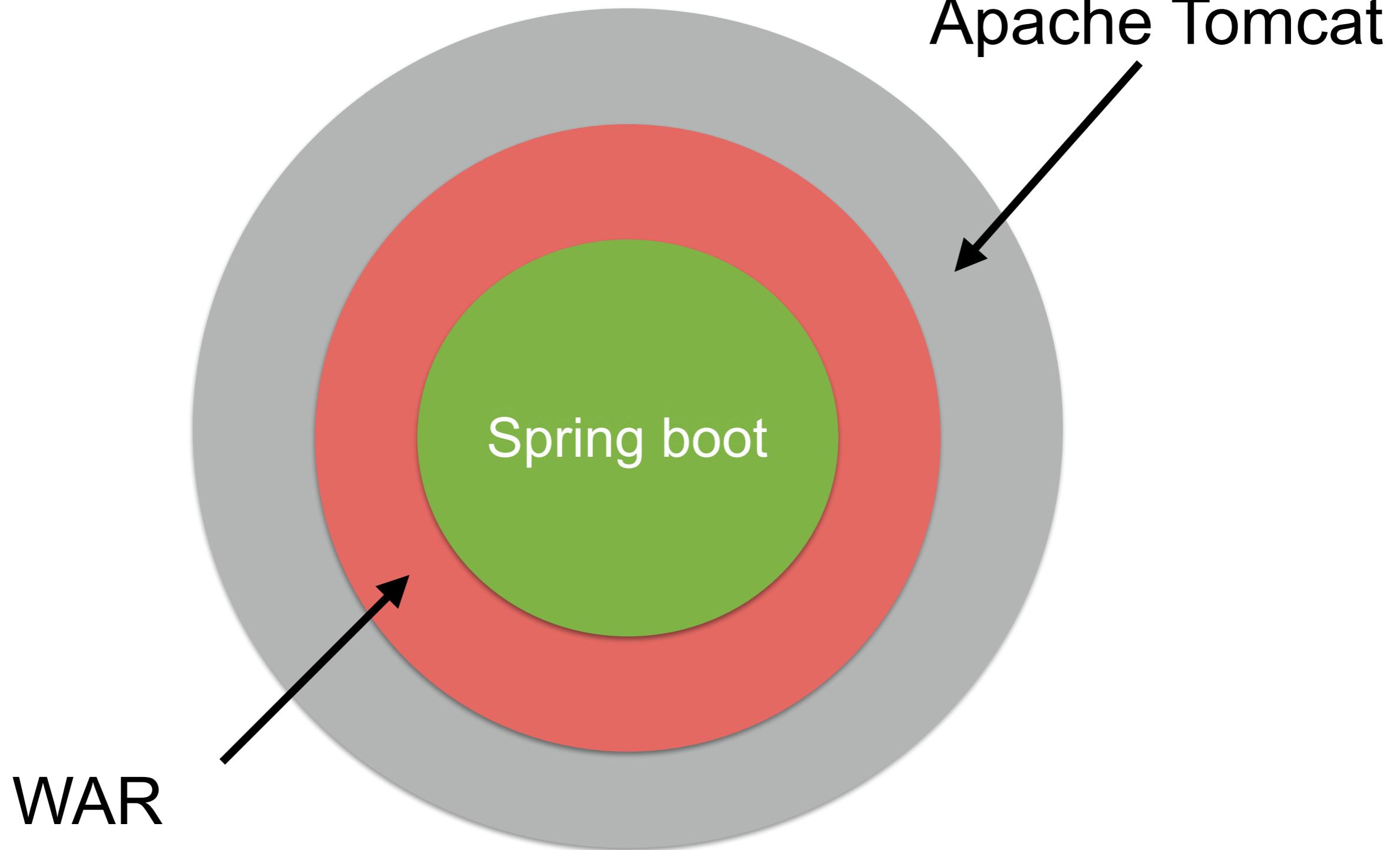
No source code generation, no XML



How ?



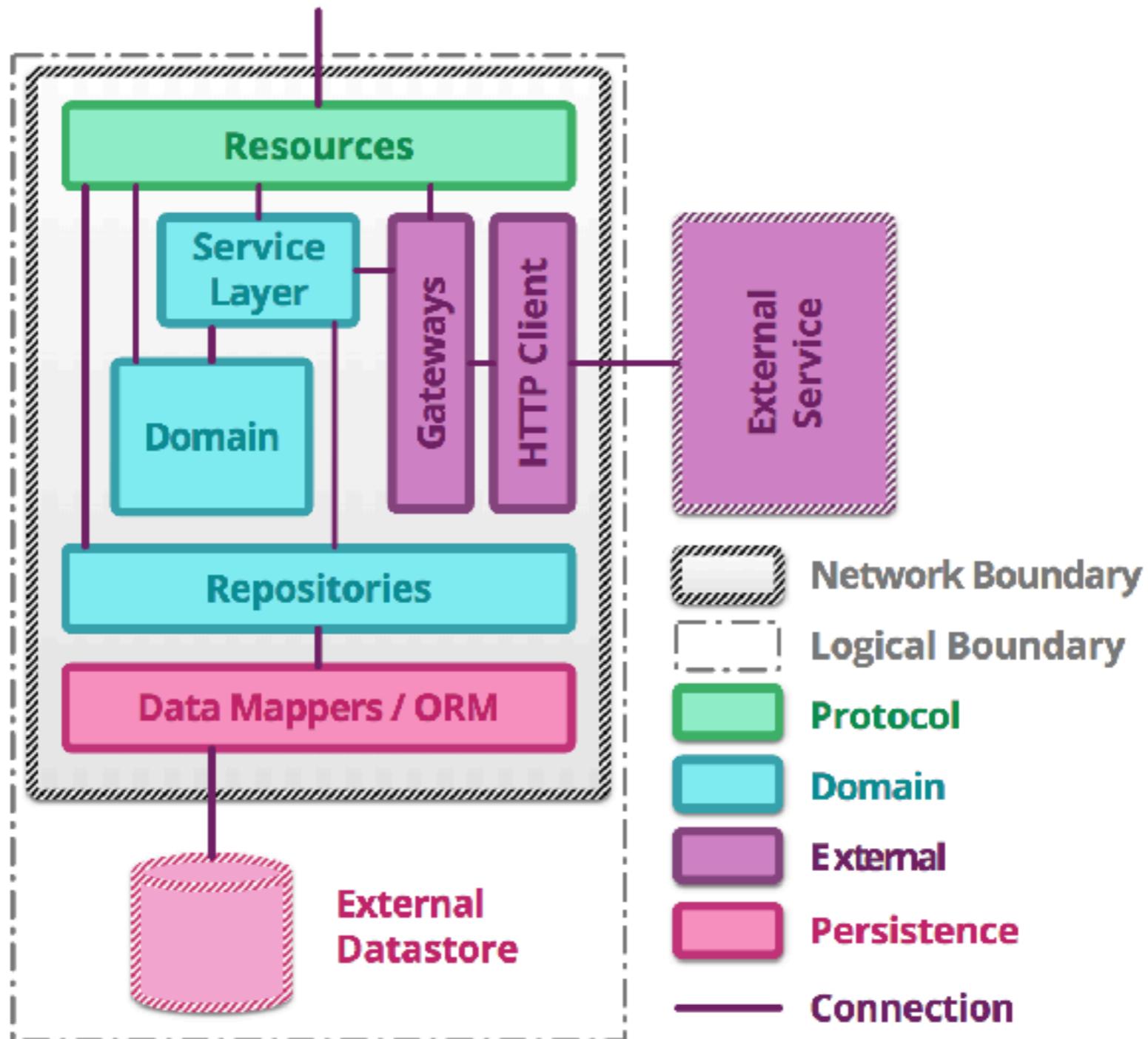
How ?



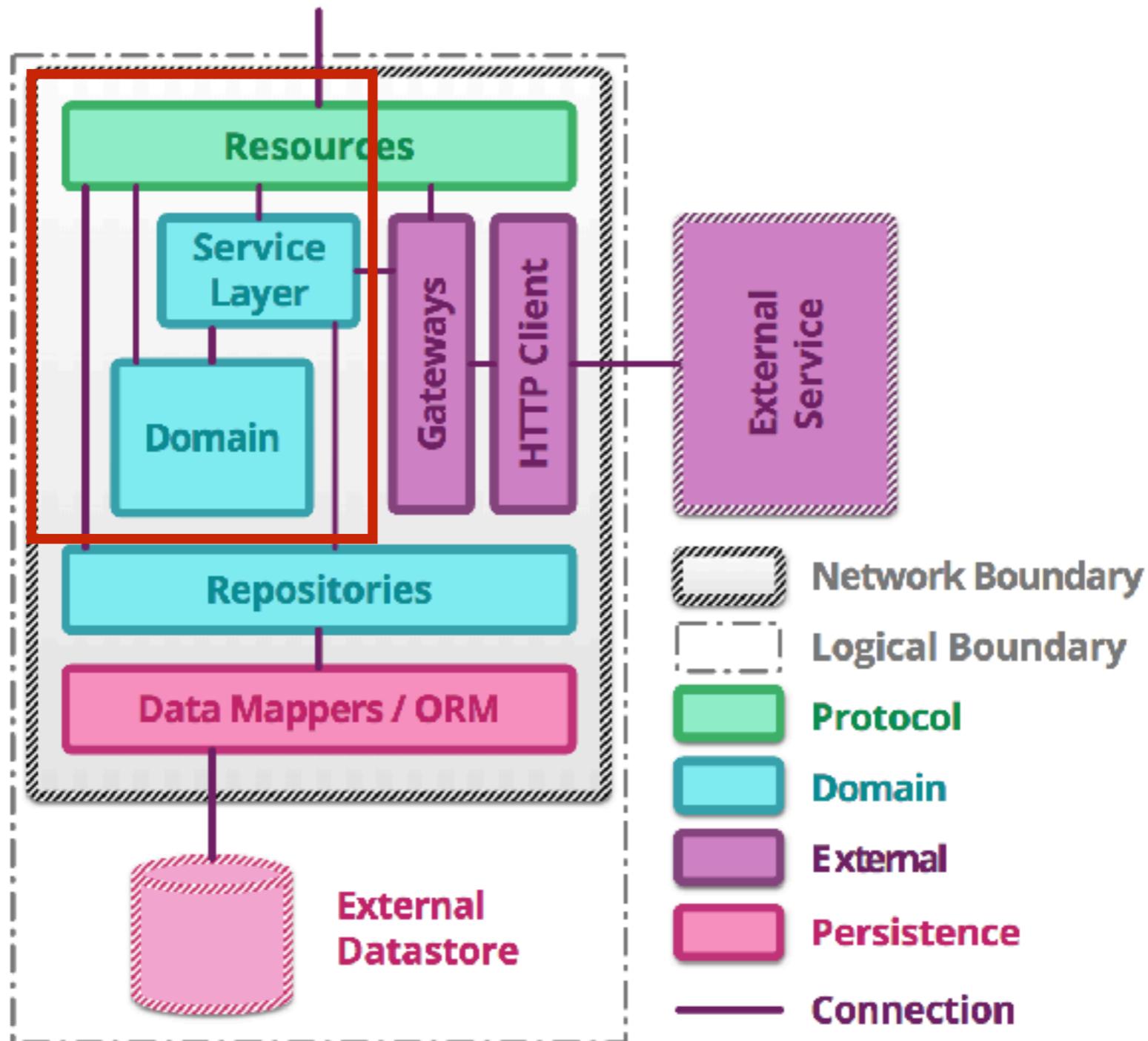
Building RESTful API with Spring Boot



Service Structure



Service Structure



Create project with Spring Initializr



Spring Initializr

<https://start.spring.io/>

SPRING INITIALIZR bootstrap your application now

Generate a with and Spring Boot

Project Metadata

Artifact coordinates

Group

Artifact

Dependencies

Add Spring Boot Starters and dependencies to your application

Search for dependencies

Selected Dependencies

Don't know what to look for? Want more options? [Switch to the full version.](#)

start.spring.io is powered by [Spring Initializr](#) and [Pivotal Web Services](#)



Structure of Spring Boot



Spring Boot main class

```
package com.example.demo;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplication
public class DemoApplication {

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



Run project

```
./mvnw package  
$java -jar target/<file name>.jar
```

```
2018-06-07 13:03:30.412  INFO 12828 --- [  
oApplication           : Starting DemoApplication on  
D 12828 (started by somkiat in /Users/somkiat/Down  
2018-06-07 13:03:30.418  INFO 12828 --- [  
oApplication           : No active profile set, fall
```



Custom banner

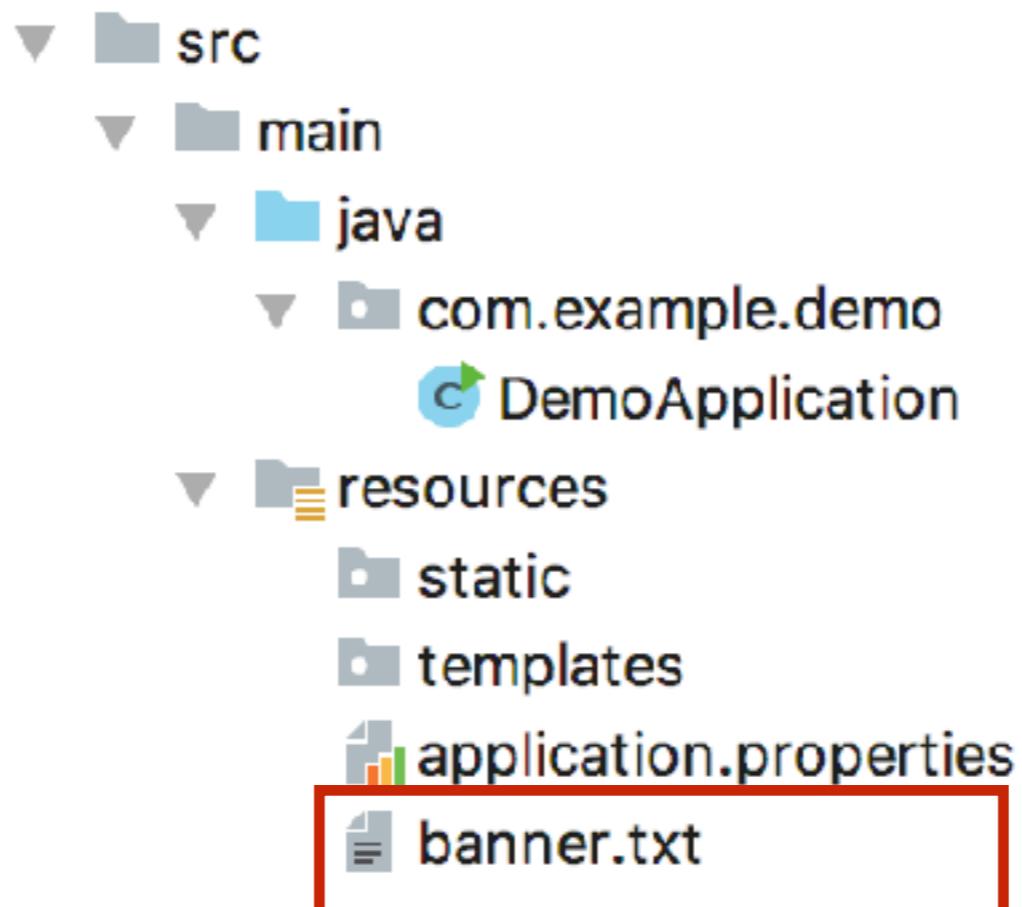
The Spring Boot logo consists of a grid of characters including slashes, parentheses, brackets, and underscores, arranged in a pattern that forms the words "Spring Boot". Below the grid, the text ":: Spring Boot ::" is written in green, and "(v2.0.2.RELEASE)" is written in gray.

```
2018-06-07 13:03:30.412  INFO 12828 --- [  
  oApplication : Starting DemoApplication on  
D 12828 (started by somkiat in /Users/somkiat/Down  
2018-06-07 13:03:30.418  INFO 12828 --- [  
  oApplication : No active profile set, fall
```



Custom banner (1)

Create file banner.txt or banner.png in resources folder



Custom banner (2)

```
@SpringBootApplication
public class DemoApplication {

    public static void main(String[] args) {
        ImageBanner banner = new ImageBanner(
            new ClassPathResource("try.png"));

        new SpringApplicationBuilder()
            .sources(DemoApplication.class)
            .banner(banner)
            .run();
    }
}
```



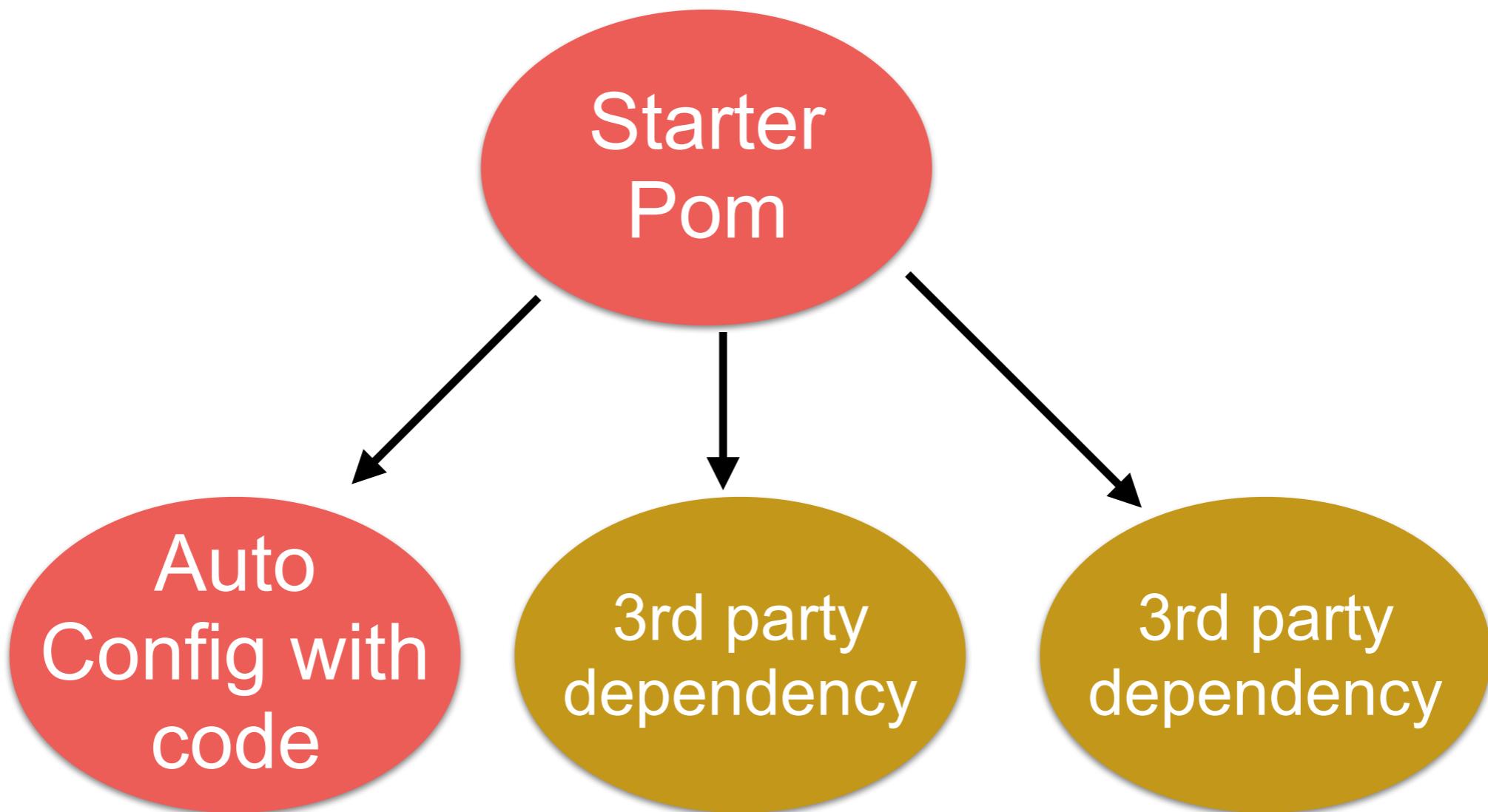
Disable banner

```
@SpringBootApplication
public class DemoApplication {

    public static void main(String[] args) {
        new SpringApplicationBuilder()
            .sources(DemoApplication.class)
            .bannerMode(Banner.Mode.OFF)
            .run(args);
    }
}
```



Anatomy of Starter



Configuration management

Properties/XML/YAML

Config server (App, Spring cloud config, git)

17 ways !!!

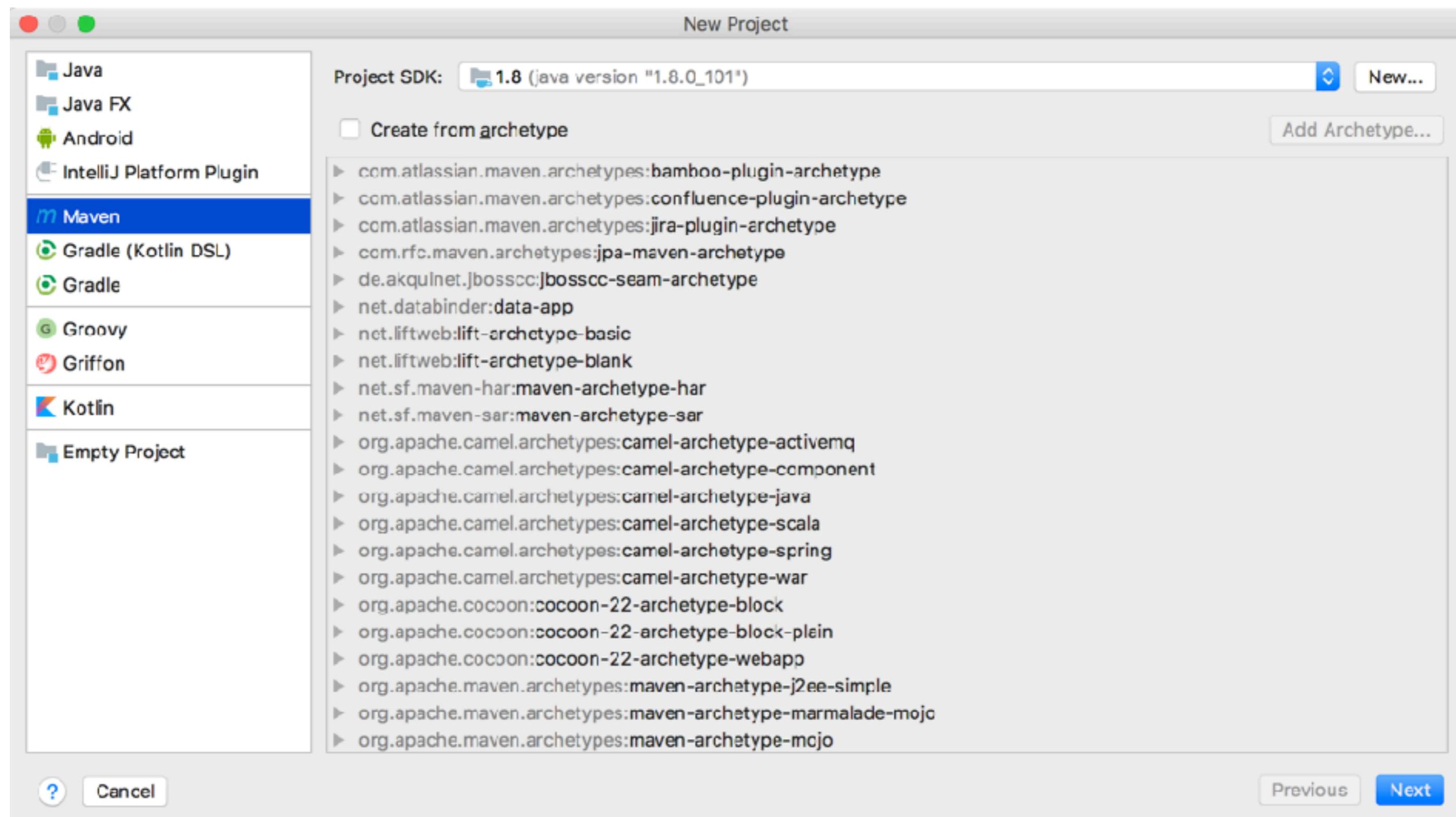
<https://docs.spring.io/spring-boot/docs/current/reference/html/boot-features-external-config.html>



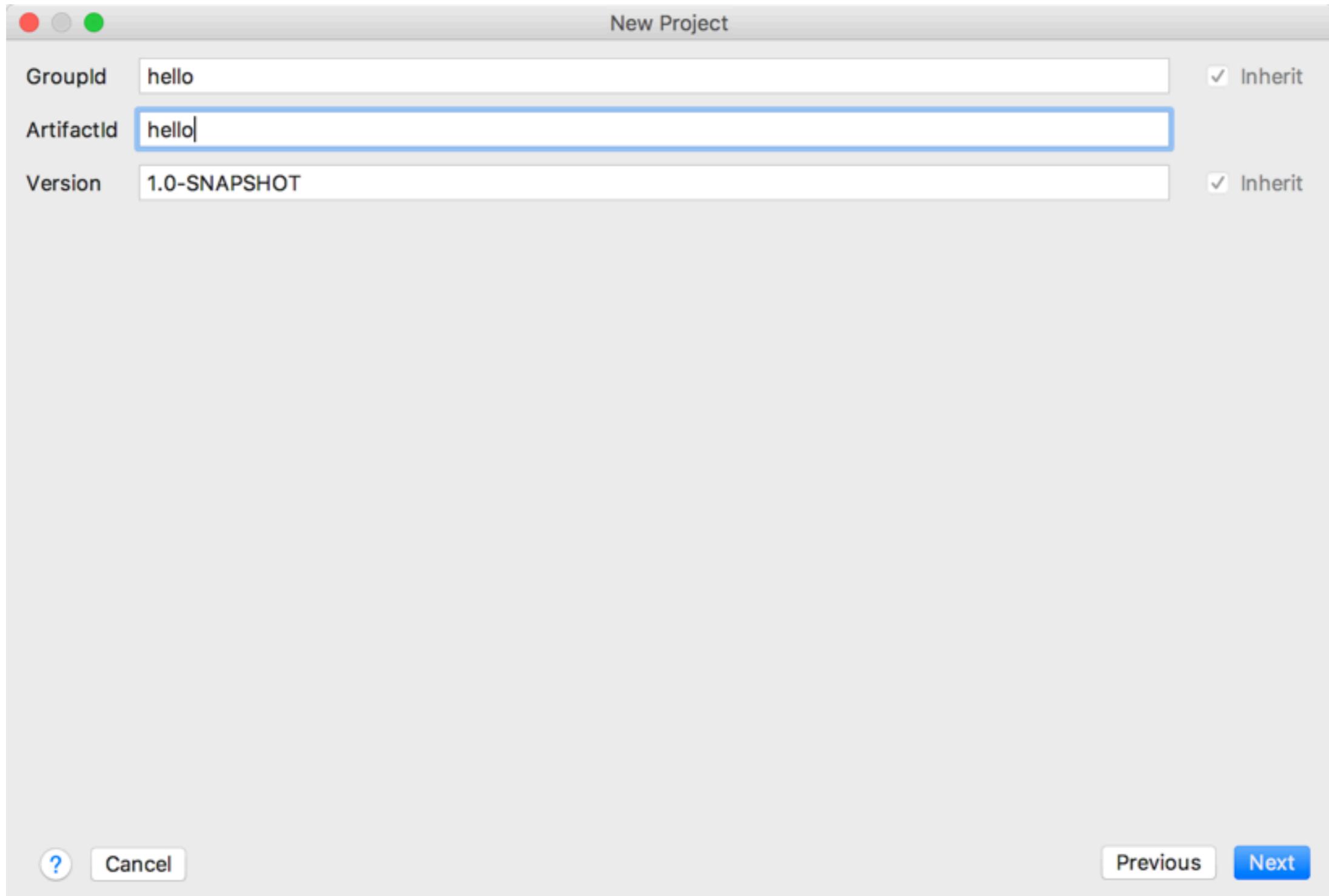
Create project with IDE



1. Create Maven Project



2. Project Name



3. Modify pom.xml (1)

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
<modelVersion>4.0.0</modelVersion>

<groupId>hello</groupId>
<artifactId>hello</artifactId>
<version>1.0-SNAPSHOT</version>
<packaging>jar</packaging>

<parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifactId>
    <version>2.0.0.RELEASE</version>
    <relativePath/> 
</parent>

<properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
    <project.reporting.outputEncoding>UTF-8</project.reporting.outputEncoding>
    <java.version>1.8</java.version>
</properties>
```



3. Modify pom.xml (2)

```
<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-web</artifactId>
    </dependency>

    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-test</artifactId>
        <scope>test</scope>
    </dependency>
</dependencies>

<build>
    <finalName>hello</finalName>
    <plugins>
        <plugin>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-maven-plugin</artifactId>
        </plugin>
    </plugins>
</build>
```



4. Create Spring boot application

hello.HelloApplication.java

```
package hello;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;

@SpringBootApplication
public class HelloApplication {

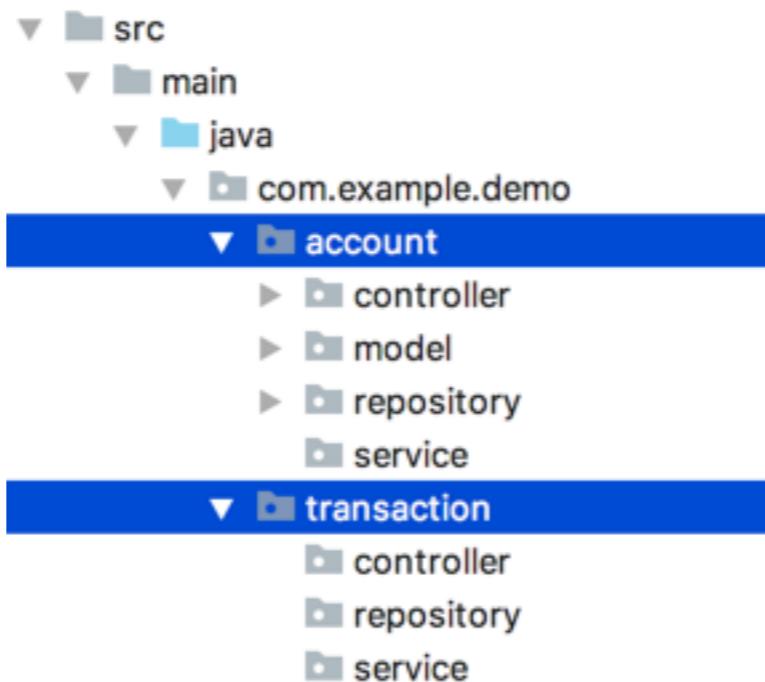
    public static void main(String[] args) {
        SpringApplication.run(HelloApplication.class, args);
    }

}
```



Spring Boot Structure

Separate by function/domain



5. Create model class

hello.model.Hello.java

```
package hello.domain;

public class Hello {

    private String message;

    public Hello(String message) {
        this.message = message;
    }

    public String getMessage() {
        return message;
    }

    public void setMessage(String message) {
        this.message = message;
    }
}
```



6. Create REST Controller

hello.controller.HelloController.java

```
package hello.controller;

import hello.domain.Hello;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.PathVariable;
import org.springframework.web.bind.annotation.RestController;

@RestController
public class HelloController {

    @GetMapping("/hello/{name}")
    public Hello sayHi(@PathVariable String name) {
        return new Hello("Hello " + name);
    }

}
```



7. Compile and Packaging

\$mvn clean package



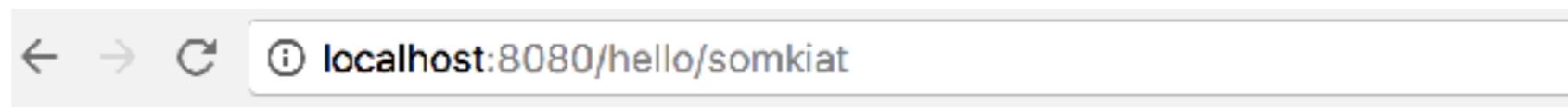
8. Run

```
$java -jar target/hello.jar
```



9. Open in browser

<http://localhost:8080/hello/somkiat>

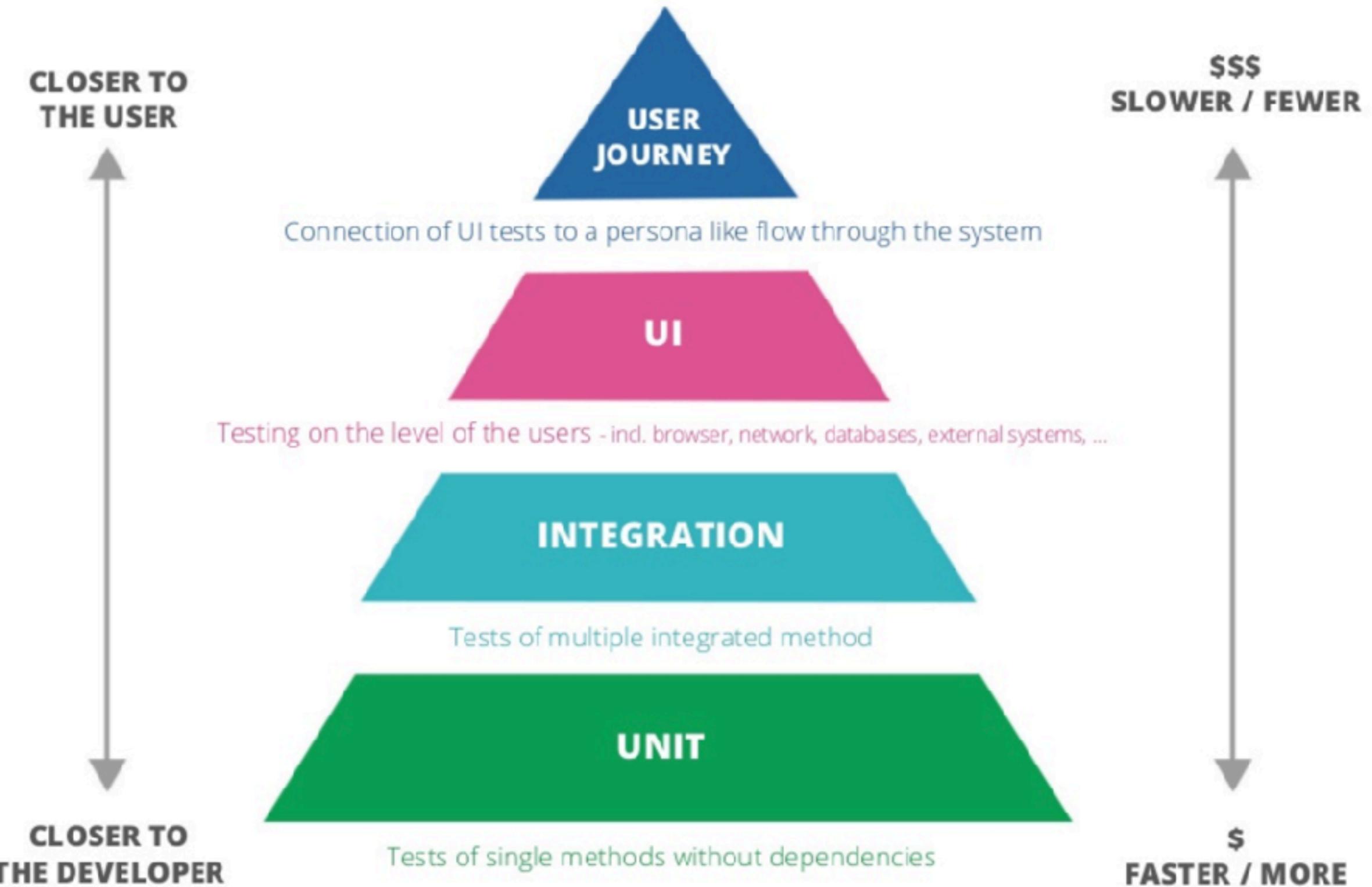


{ "message": "Hello somkiat" }



How to test the Hello service ?





Unit tests

How to use model ?

```
public class HelloTest {  
  
    @Test  
    public void success_to_create_model_with_constructor() {  
        Hello hello = new Hello("Somkiat");  
        assertEquals( expected: "Somkiat", hello.getMessage());  
    }  
  
}
```



API/Controller tests

How to use controller ?

Spring boot provides MockMvc to test Controller

```
package hello.controller;

import hello.domain.Hello;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.PathVariable;
import org.springframework.web.bind.annotation.RestController;

@RestController
public class HelloController {

    @GetMapping("/hello/{name}")
    public Hello sayHi(@PathVariable String name) {
        return new Hello("Hello " + name);
    }

}
```



API/Controller tests

```
@RunWith(SpringRunner.class)
@WebMvcTest/controllers = HelloController.class)
public class HelloControllerTest {

    @Autowired
    private MockMvc mockMvc;

    @Test
    public void shouldReturnHelloSomkiat() throws Exception {
        mockMvc.perform(get(urlTemplate: "/hello/somkiat"))
            .andExpect(jsonPath(expression: "$.message")
                .value(expectedValue: "Hello somkiat"))
            .andExpect(status().is2xxSuccessful());
    }

}
```



API/Controller tests

With Spring Boot Testing + TestRestTemplate

```
@RunWith(SpringRunner.class)
@SpringBootTest(
    webEnvironment = WebEnvironment.RANDOM_PORT)
public class AccountControllerTest {

    @Autowired
    private TestRestTemplate testRestTemplate;

    @Autowired
    private AccountRepository accountRepository;

    @Before
    public void initData() {
        accountRepository.save(new Account("01"));
        accountRepository.save(new Account("02"));
    }
}
```



API/Controller tests

With Spring Boot Testing + TestRestTemplate

```
@Test  
public void  
    เรียกข้อมูลบัญชีของหมายเลข_0868696209_ต้องเจอสองบัญชีนั่น () {  
    List<AccountResponse> accountResponses  
        = testRestTemplate.getForObject(  
            "/account/0868696209", List.class);  
  
    assertEquals(2, accountResponses.size());  
}
```



Compile with testing

\$mvn clean package

```
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 2, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO]
```



% of Code/Test coverage



Add coverage to pom.xml (1)

```
<build>
    <finalName>hello</finalName>
    <plugins>
        <plugin>
            <groupId>org.springframework.boot</groupId>
            <artifactId>spring-boot-maven-plugin</artifactId>
        </plugin>

        <plugin>
            <artifactId>maven-compiler-plugin</artifactId>
            <version>2.5.1</version>
            <configuration>
                <source>${java.version}</source>
                <target>${java.version}</target>
                <encoding>${project.build.sourceEncoding}</encoding>
            </configuration>
        </plugin>
    </plugins>
</build>
```



Add coverage to pom.xml (2)

```
<plugin>
  <groupId>org.codehaus.mojo</groupId>
  <artifactId>cobertura-maven-plugin</artifactId>
  <version>2.7</version>
  <configuration>
    <formats>
      <format>html</format>
      <format>xml</format>
    </formats>
  </configuration>
  <executions>
    <execution>
      <phase>package</phase>
      <goals>
        <goal>cobertura</goal>
      </goals>
    </execution>
  </executions>
  <dependencies>
    <dependency>
      <groupId>org.ow2.asm</groupId>
      <artifactId>asm</artifactId>
      <version>5.0.3</version>
    </dependency>
  </dependencies>
</plugin>
```



Run test again

\$mvn clean package

Cobertura Report generation was successful.

Cobertura 2.1.1 - GNU GPL License (NO WARRANTY) - See COPYRIGHT file

Cobertura: Loaded information on 3 classes.

time: 125ms

Cobertura Report generation was successful.

BUILD SUCCESS



Coverage report

open target/site/cobertura/index.html

Packages

All
[hello](#)
[hello.controller](#)
[hello.domain](#)

All Packages

Classes

[Hello \(66%\)](#)
[HelloApplication \(33%\)](#)
[HelloController \(100%\)](#)

Coverage Report - All Packages

Package	# Classes	Line Coverage	Branch Coverage	Complexity
All Packages	3	63% <div style="width: 63%;"></div> 7/11	N/A	N/A
hello	1	33% <div style="width: 33%;"></div> 1/3	N/A	N/A
hello.controller	1	100% <div style="width: 100%;"></div> 2/2	N/A	N/A
hello.domain	1	66% <div style="width: 66%;"></div> 4/6	N/A	N/A

Report generated by [Cobertura](#) 2.1.1 on 3/6/18 12:40 AM.

The logo features a stylized bird with outstretched wings, possibly a peacock, with intricate patterns on its feathers, set against a dark background.

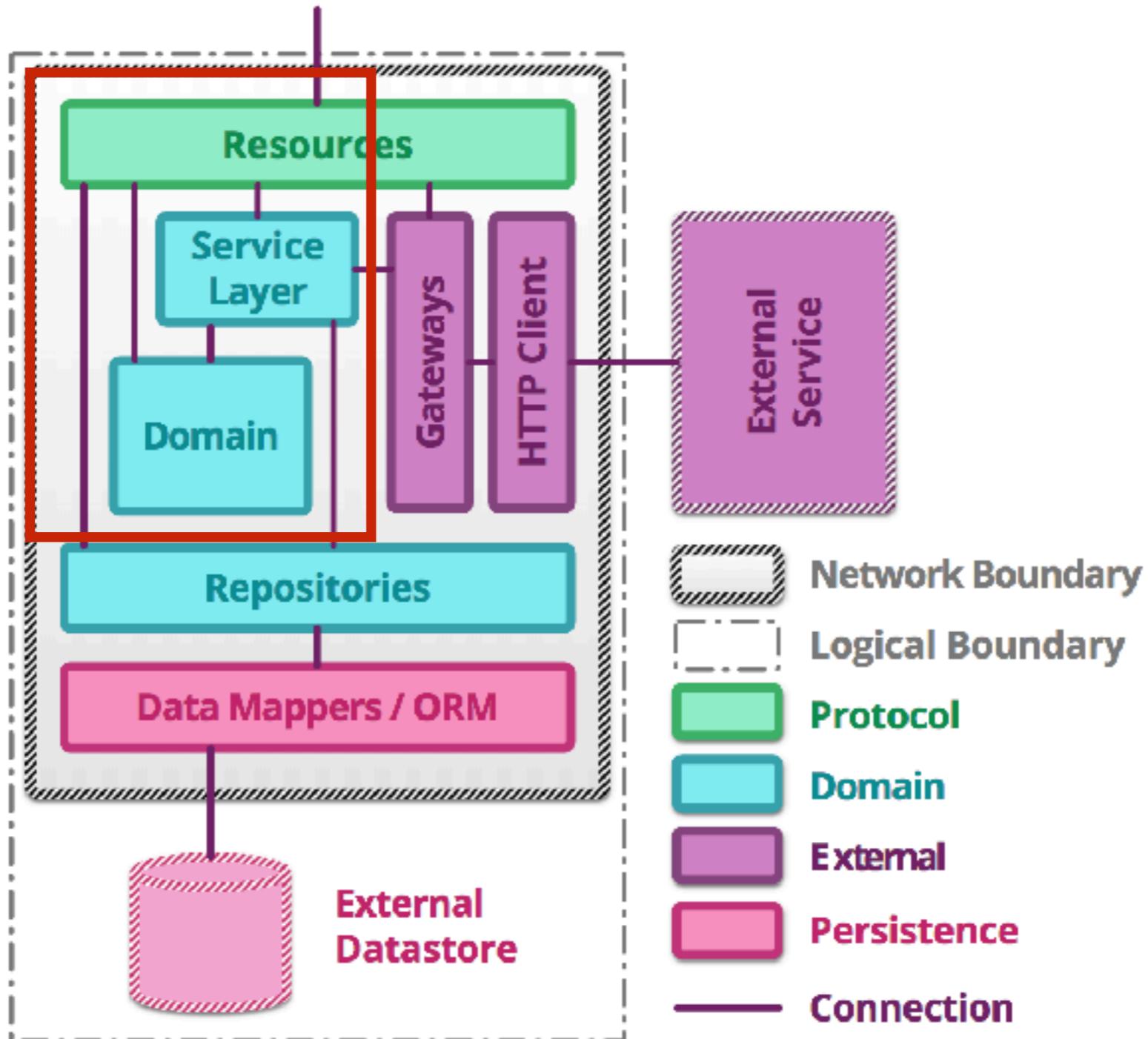
Java Framework
© 2017 - 2018 Siam Chamnkit Company Limited. All rights reserved.

61

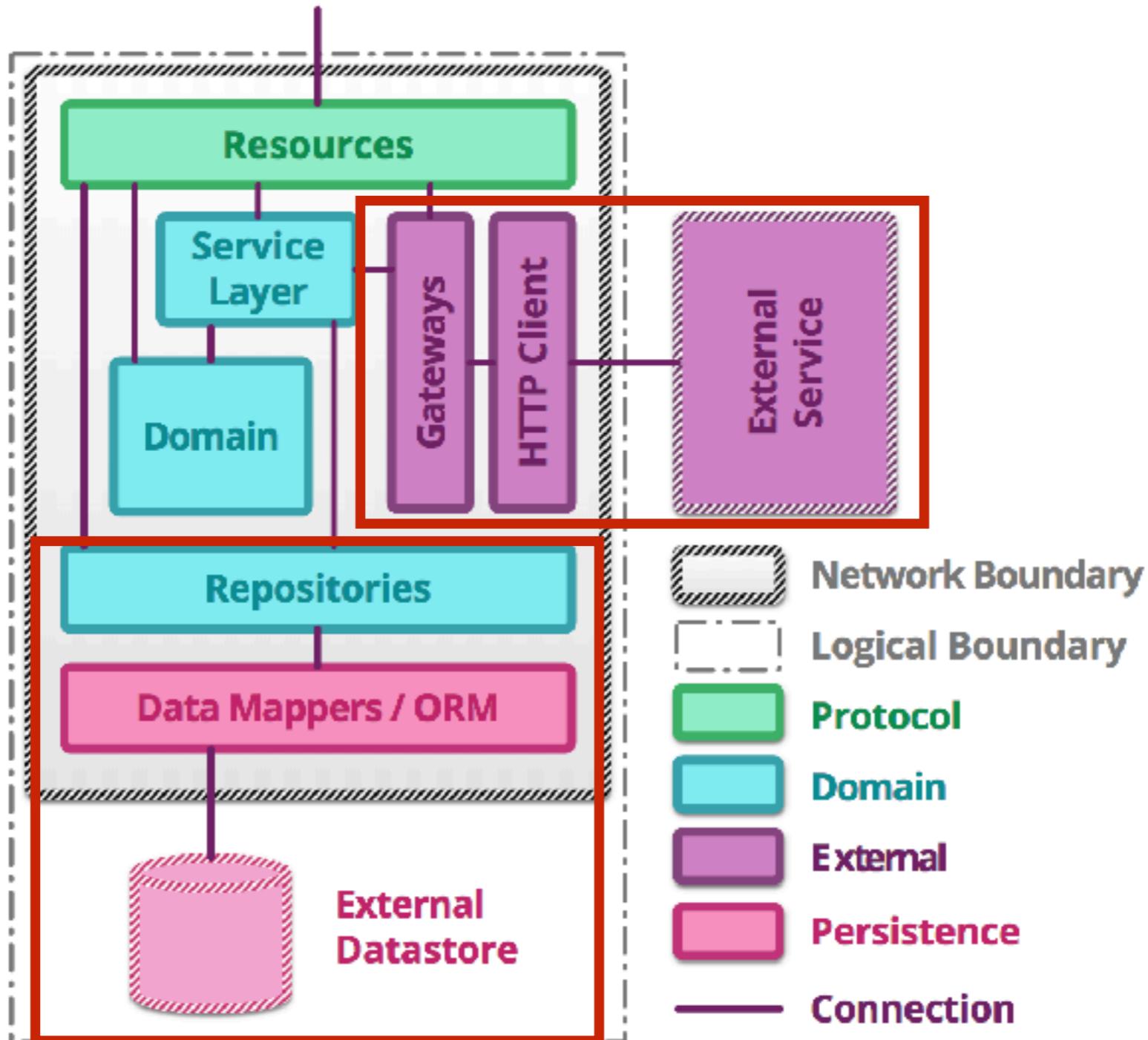
How to improve % of coverage ?



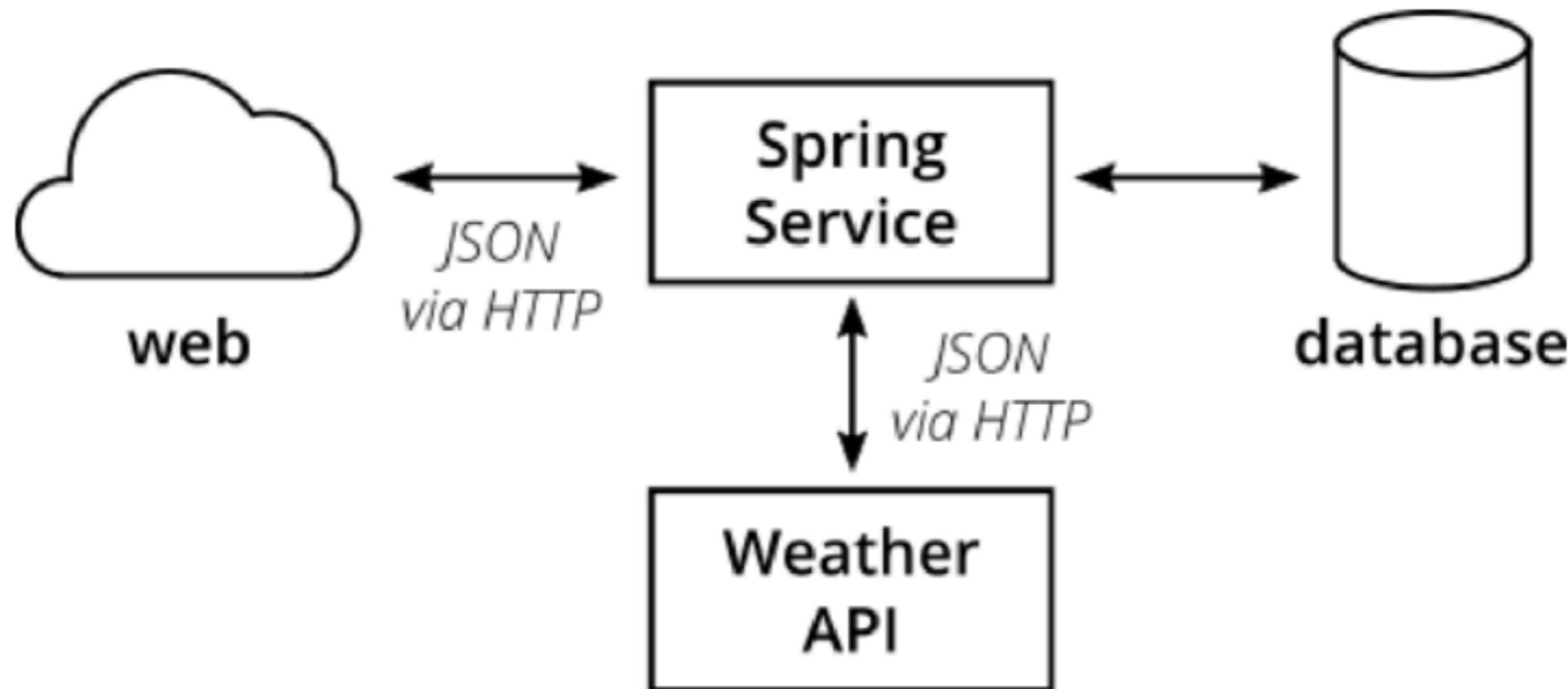
Service Structure



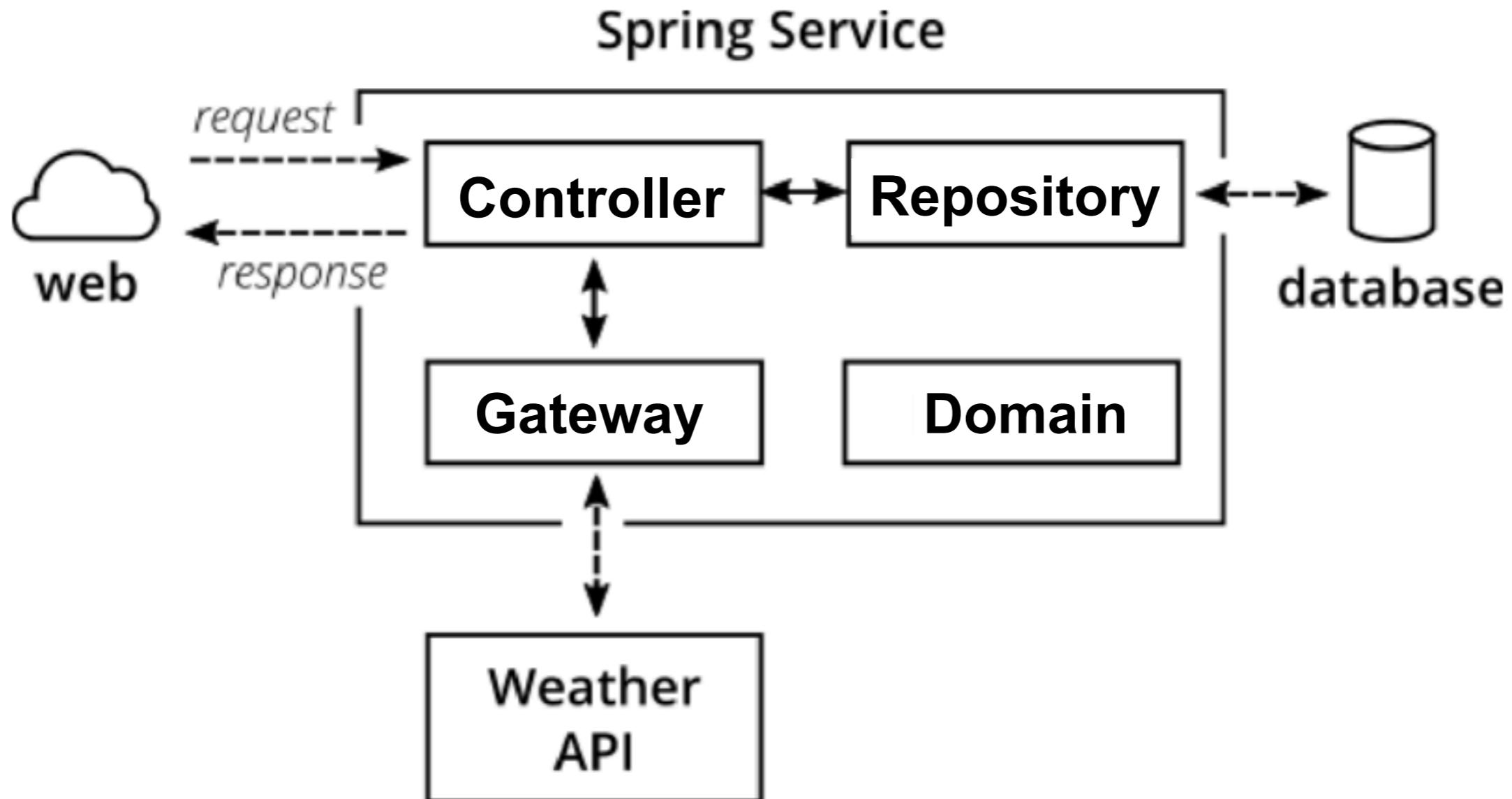
Service Structure



Sample application

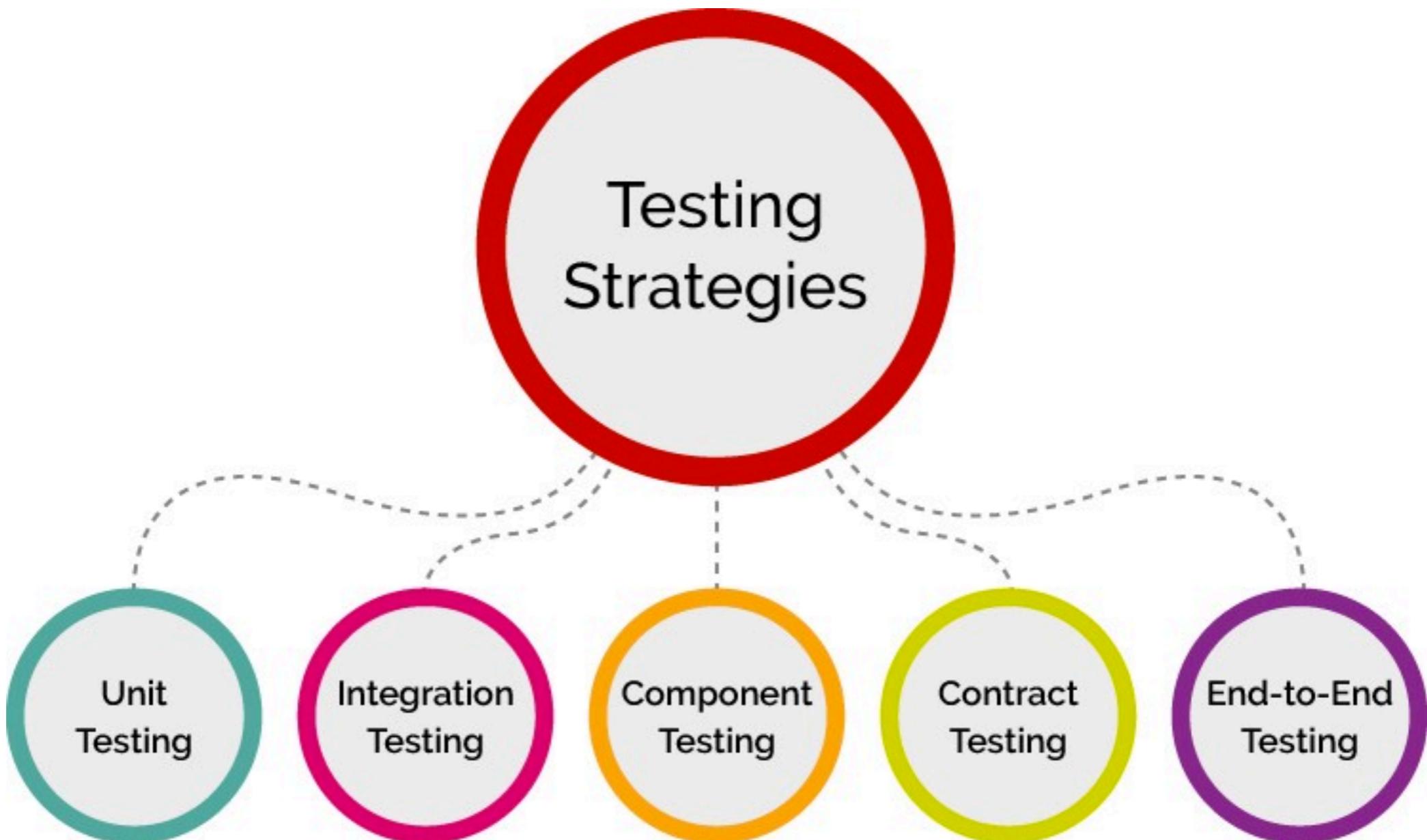


Project structure

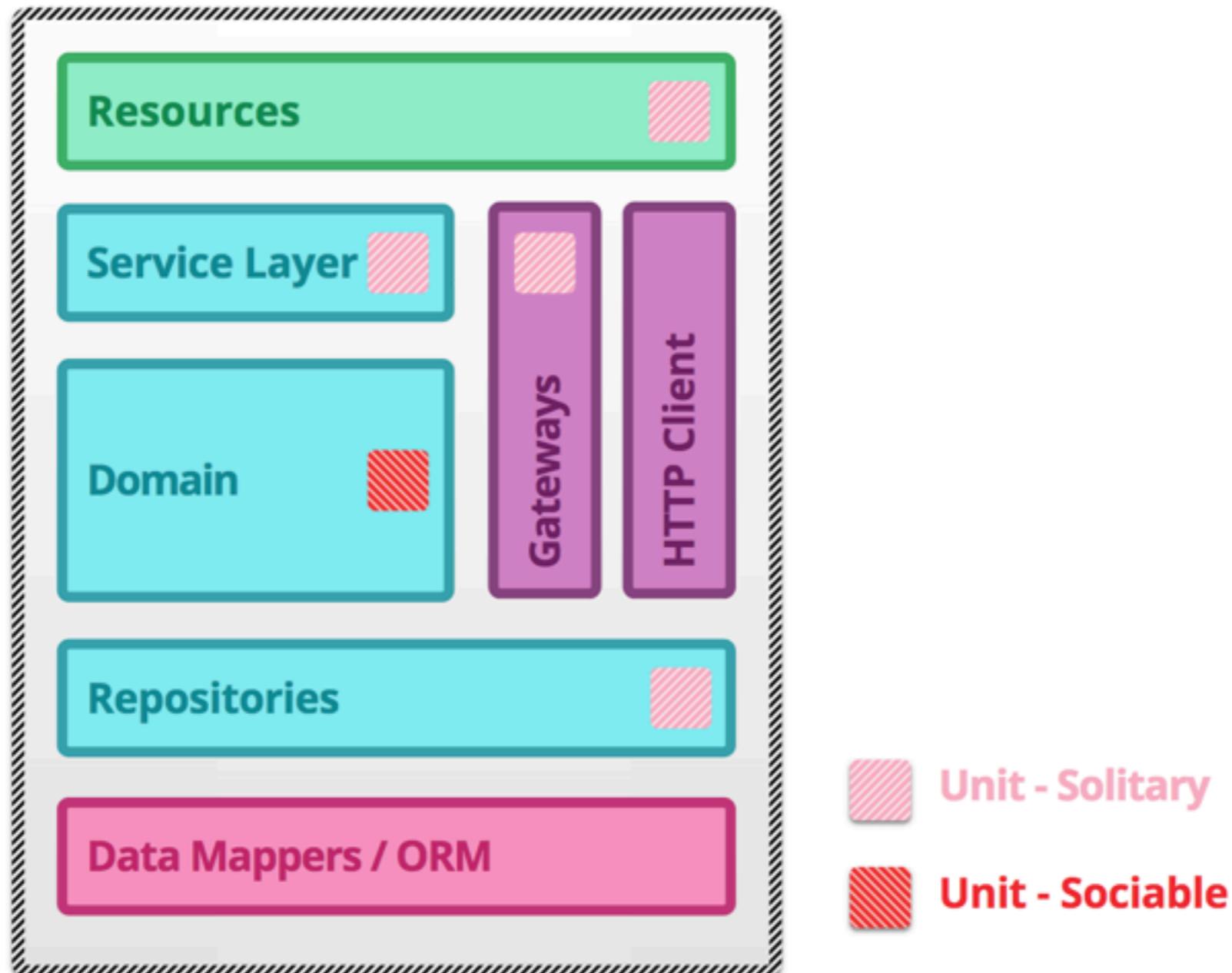


How to test ?

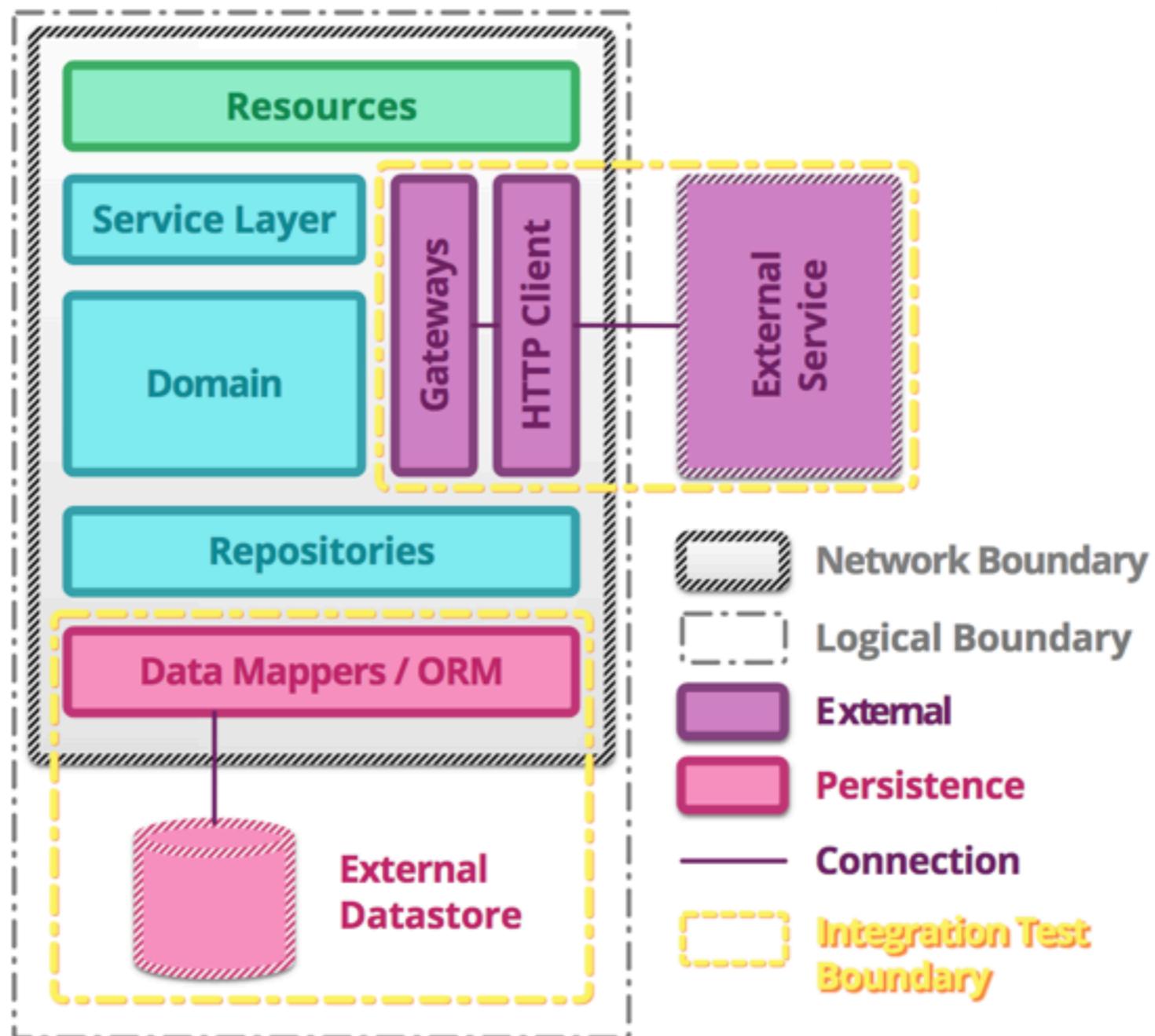




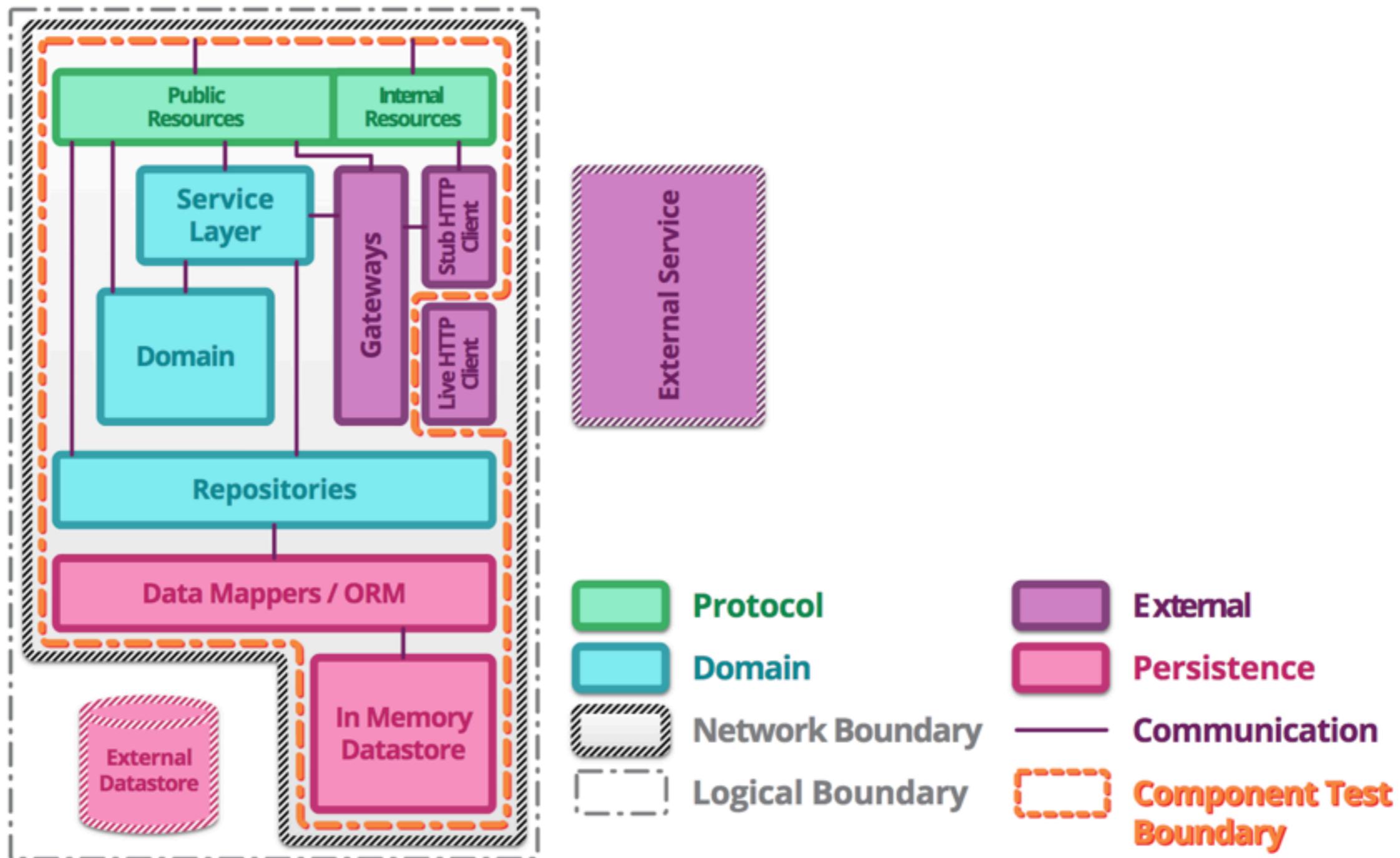
Unit testing



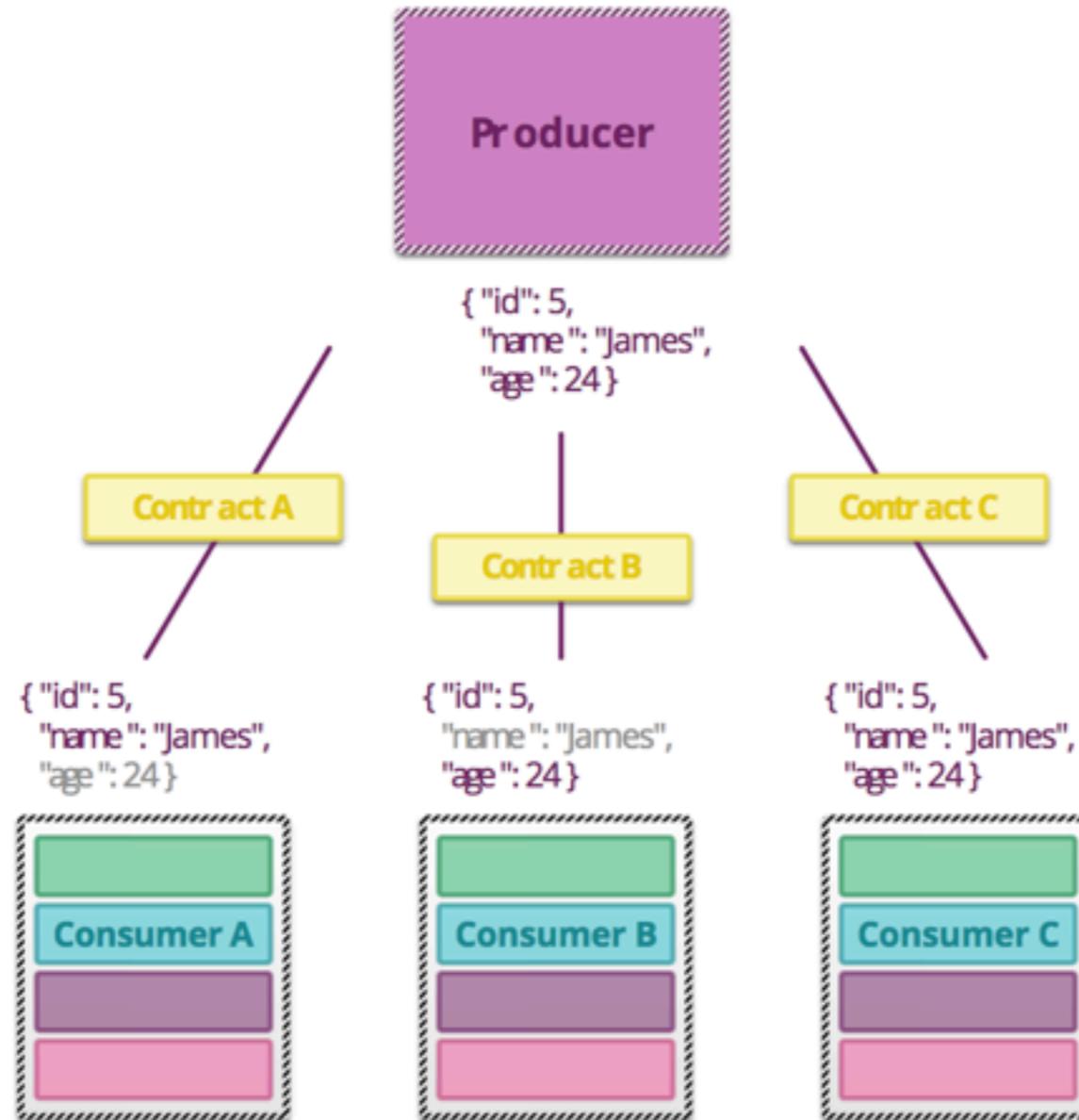
Integration testing



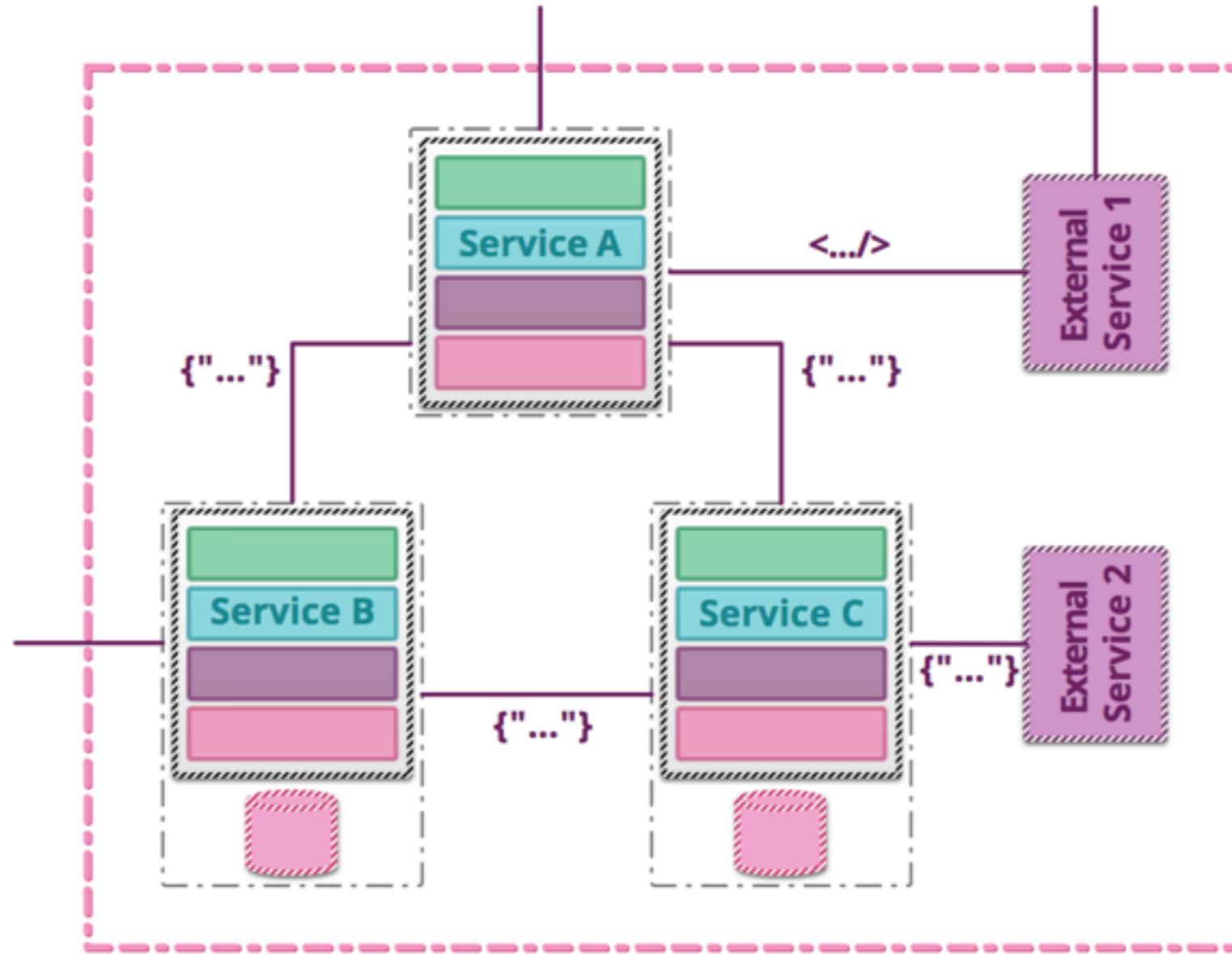
Component testing



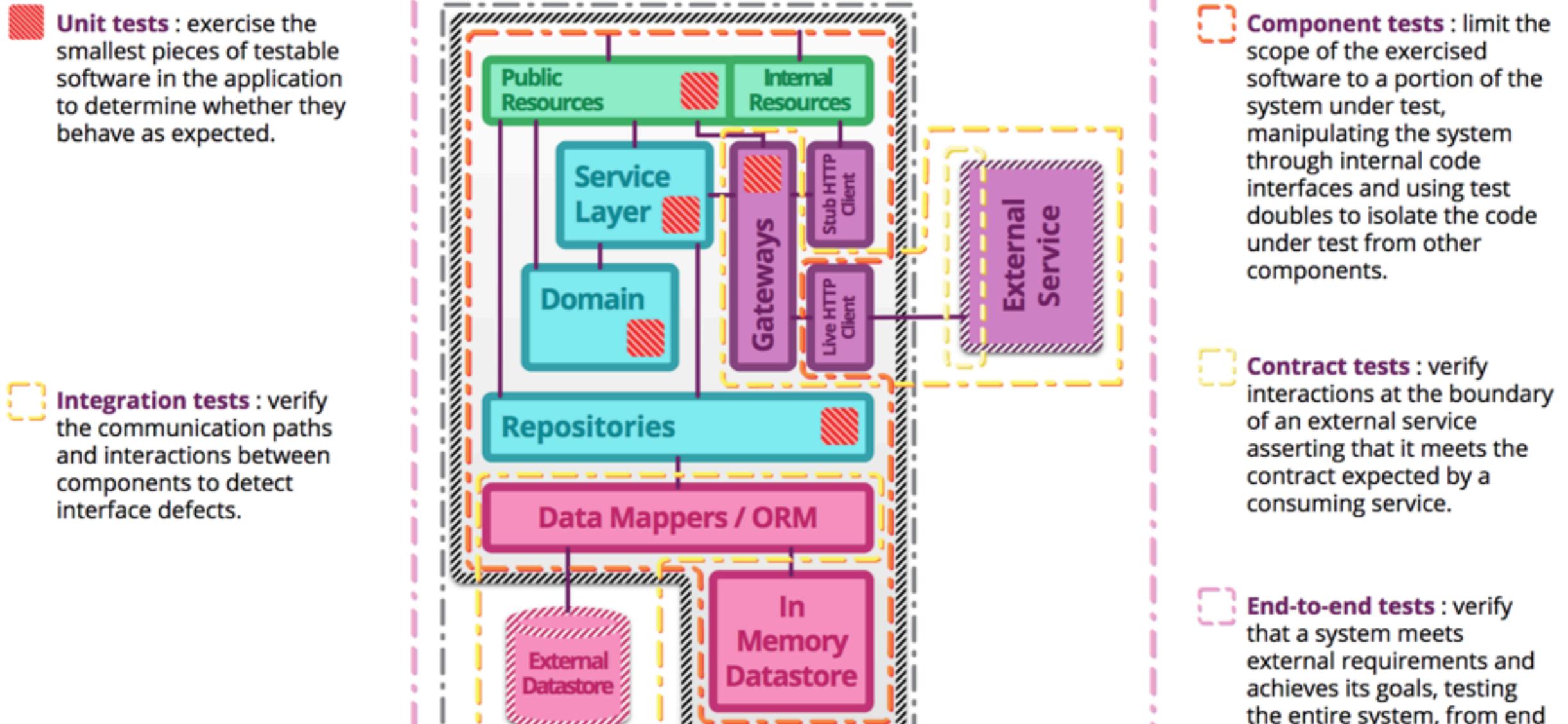
Contract testing



End-to-End testing



Summary



Unit tests : exercise the smallest pieces of testable software in the application to determine whether they behave as expected.

Integration tests : verify the communication paths and interactions between components to detect interface defects.

Component tests : limit the scope of the exercised software to a portion of the system under test, manipulating the system through internal code interfaces and using test doubles to isolate the code under test from other components.

Contract tests : verify interactions at the boundary of an external service asserting that it meets the contract expected by a consuming service.

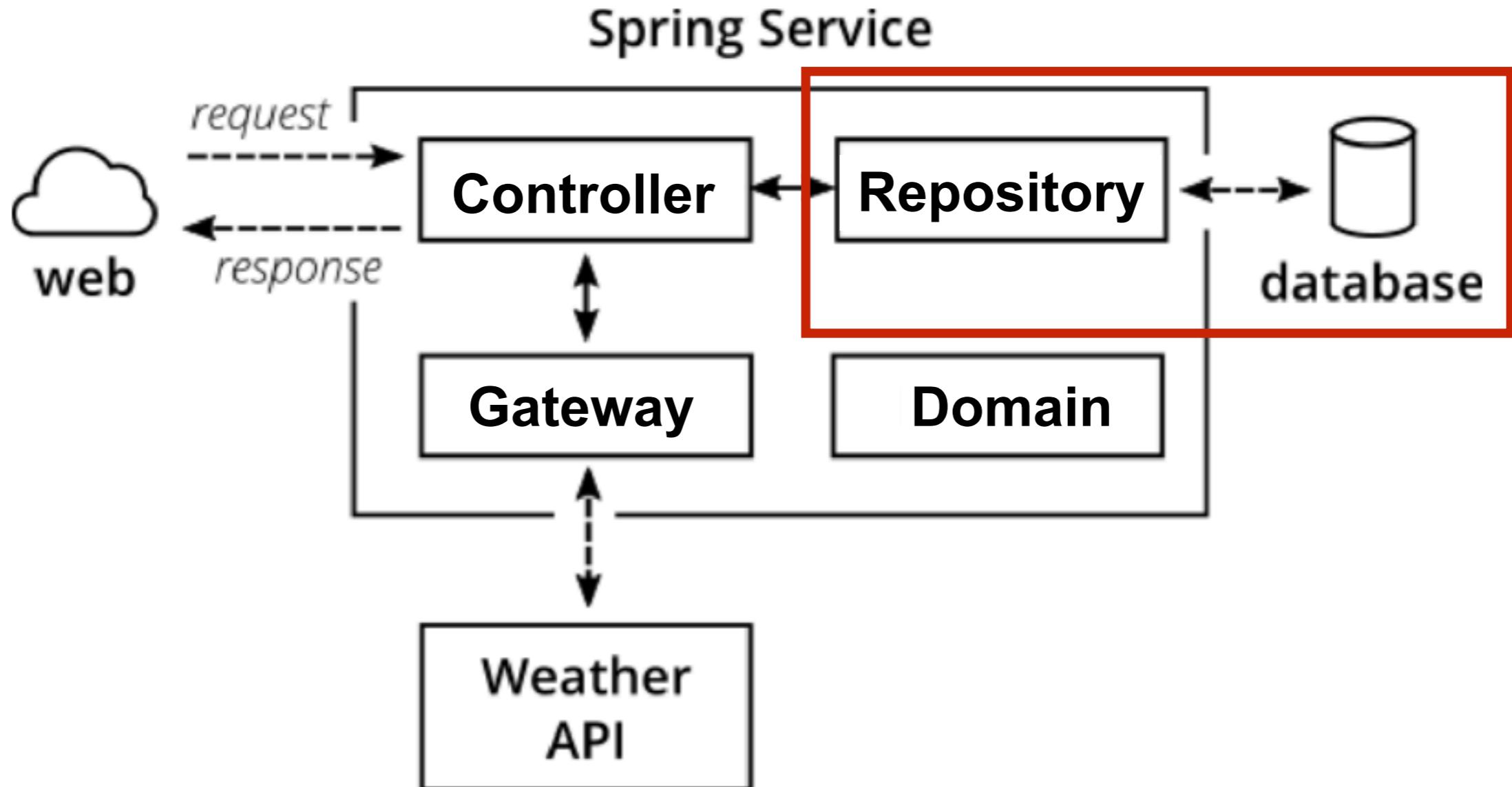
End-to-end tests : verify that a system meets external requirements and achieves its goals, testing the entire system, from end to end.



Let's workshop with Repository



Working with repository



Working with repository

We're using Spring Data



Modify pom.xml

Add library of Spring Data

```
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-data-jpa</artifactId>
</dependency>
```



Modify pom.xml

Add library of Persistence/data store

```
<dependency>
    <groupId>org.postgresql</groupId>
    <artifactId>postgresql</artifactId>
    <version>42.1.1</version>
</dependency>
```



Add data store config

In src/main/resources

```
spring.datasource.url= jdbc:postgresql://127.0.0.1:15432/postgres
spring.datasource.username= user
spring.datasource.password= password
spring.datasource.platform= POSTGRESQL

spring.jpa.show-sql= true
spring.jpa.hibernate.ddl-auto= create-drop
spring.jpa.database-platform= org.hibernate.dialect.PostgreSQLDialect
```



Create repository interface

hello.repository.PersonRepository.java

```
public interface PersonRepository  
    extends CrudRepository<Person, String> {  
  
    Optional<Person> findByFirstName(String name);  
  
}
```



Create Entity class

hello.repository.Person.java

```
@Entity
public class Person {

    @Id
    @GeneratedValue(strategy = GenerationType.AUTO)
    private int id;
    private String firstName;
    private String lastName;

    public Person() {
    }

    public Person(String firstName, String lastName) {
        this.firstName = firstName;
        this.lastName = lastName;
    }
}
```



Create new controller

hello.repository.HelloControllerWithRepository.java

```
public class HelloControllerWithRepository {  
  
    private final PersonRepository personRepository;  
  
    @Autowired  
    public HelloControllerWithRepository(PersonRepository personRepository) {  
        this.personRepository = personRepository;  
    }  
  
    @GetMapping("/hello/data/{name}")  
    public Hello sayHi(@PathVariable String name) {  
        Optional<Person> foundPerson = personRepository.findByName(name);  
        String result = foundPerson  
            .map(person -> String.format("Hello %s", person.getFirstName()))  
            .orElse( other: "Data not found");  
        return new Hello(result);  
    }  
}
```



Run test and package

\$mvn clean package

```
Cobertura Report generation was successful.  
Cobertura 2.1.1 - GNU GPL License (NO WARRANTY) - See COPYRIGHT file  
Cobertura: Loaded information on 3 classes.  
time: 125ms
```

```
Cobertura Report generation was successful.
```

```
BUILD SUCCESS
```



Run your application

```
$java -jar target/hello.jar
```



Coverage report

Packages

All
[hello](#)
[hello.controller](#)
[hello.domain](#)
[hello.repository](#)

Coverage Report - All Packages

Package	# Classes	Line Coverage	Branch Coverage	Complexity
All Packages	6	25% 7/28	N/A	N/A
hello	1	33% 1/3	N/A	N/A
hello.controller	2	20% 2/10	N/A	N/A
hello.domain	1	66% 4/6	N/A	N/A
hello.repository	2	0% 0/9	N/A	N/A

Report generated by Cobertura 2.1.1 on 3/6/18 8:52 AM.

All Packages

Classes

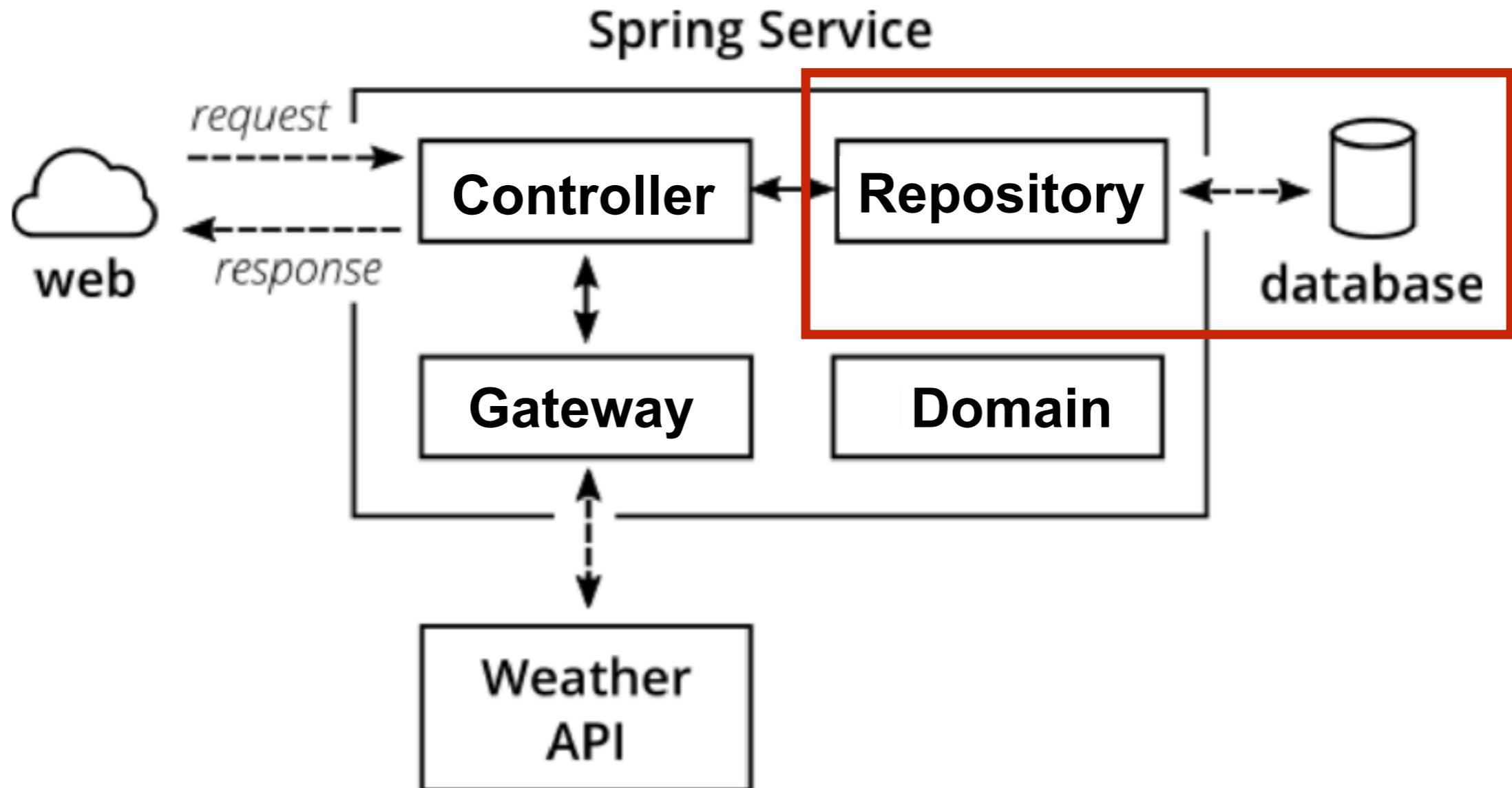
[Hello](#) (65%)
[HelloApplication](#) (33%)
[HelloController](#) (100%)
[HelloControllerWithRepository](#) (0%)
[Person](#) (0%)
[PersonRepository](#) (N/A)



How to test ?



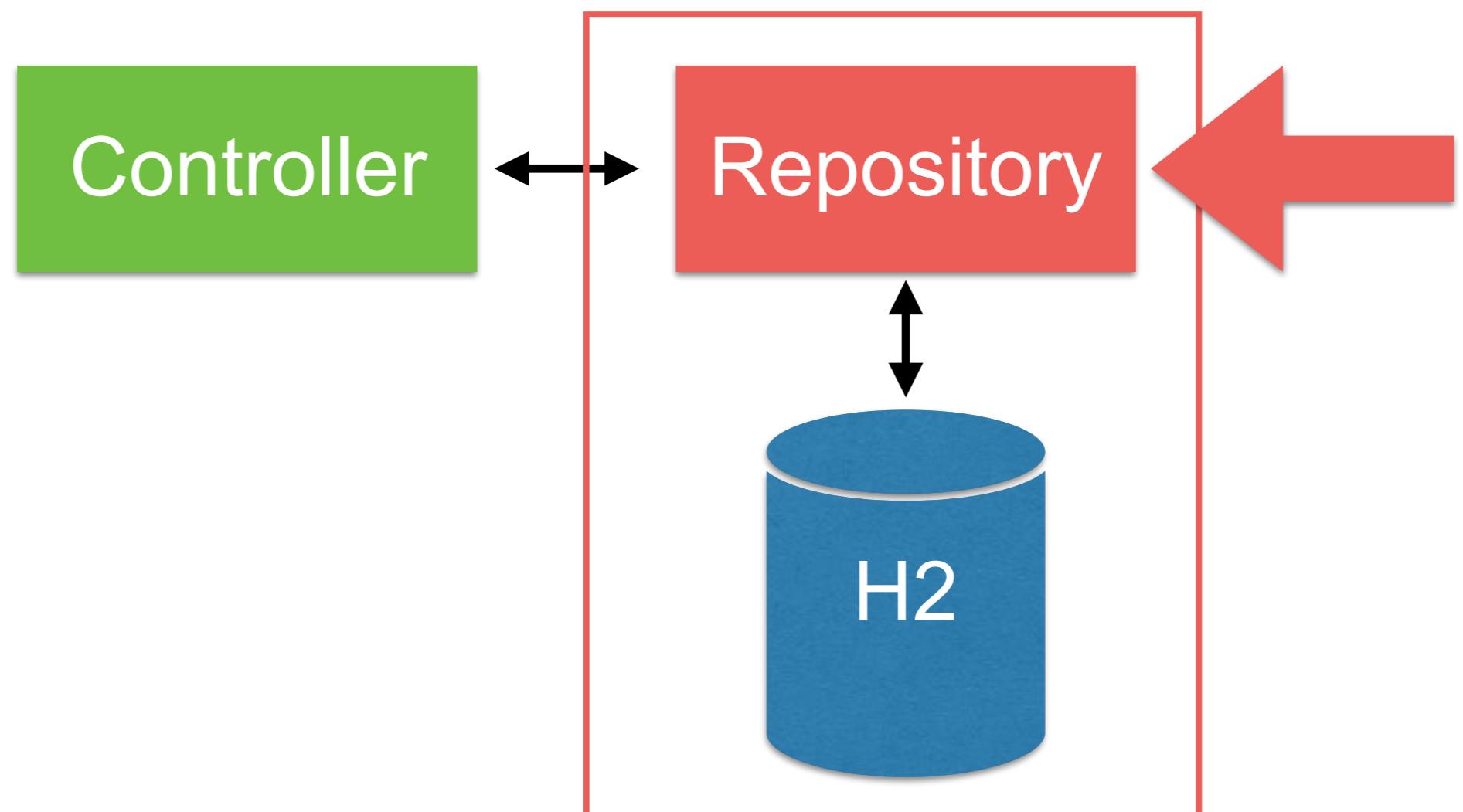
How to test with Repository ?



Repository Testing

Using `@DataJpaTest`

Spring Testing



Spring boot provide DataJpaTest

should be add H2 library to pom.xml

```
<dependency>
    <groupId>com.h2database</groupId>
    <artifactId>h2</artifactId>
    <scope>test</scope>
</dependency>
```



Repository Testing (1)

```
@RunWith(SpringRunner.class)
@DataJpaTest
public class PersonRepositoryTest {

    @Autowired
    private PersonRepository personRepository;

    @After
    public void clearData() {
        personRepository.deleteAll();
    }
}
```



Repository Testing (2)

Add a test case

```
@Test  
public void shouldSaveAndGetData() throws Exception {  
    //Arrange  
    Person somkiat = new Person("somkiat", "pui");  
    personRepository.save(somkiat);  
  
    Optional<Person> shouldSomkiat  
        = personRepository.findByFirstName("somkiat");  
  
    assertEquals(expected: "somkiat",  
        shouldSomkiat.get().getFirstName());  
}
```



Run test and package

\$mvn clean package

```
Cobertura Report generation was successful.  
Cobertura 2.1.1 - GNU GPL License (NO WARRANTY) - See COPYRIGHT file  
Cobertura: Loaded information on 3 classes.  
time: 125ms
```

```
Cobertura Report generation was successful.
```

```
BUILD SUCCESS
```

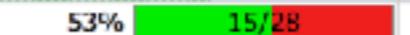
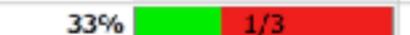


Coverage report

Packages

All
[hello](#)
[hello.controller](#)
[hello.domain](#)
[hello.repository](#)

Coverage Report - All Packages

Package	# Classes	Line Coverage	Branch Coverage	Complexity
All Packages	6	53%  15/28	N/A	N/A
hello	1	33%  1/3	N/A	N/A
hello.controller	2	20%  2/10	N/A	N/A
hello.domain	1	66%  4/6	N/A	N/A
hello.repository	2	88%  8/9	N/A	N/A

Report generated by [Cobertura](#) 2.1.1 on 3/6/18 9:32 AM.

All Packages

Classes

[Hello](#) (66%)
[HelloApplication](#) (33%)
[HelloController](#) (100%)
[HelloControllerWithRepository](#) (0%)
[Person](#) (88%)
[PersonRepository](#) (N/A)

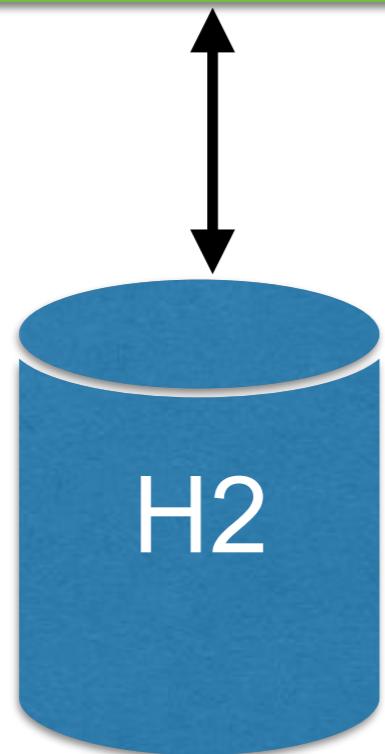


Working with Real Database

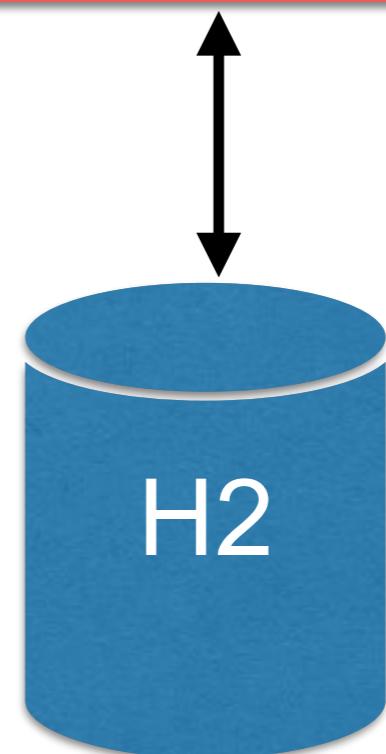
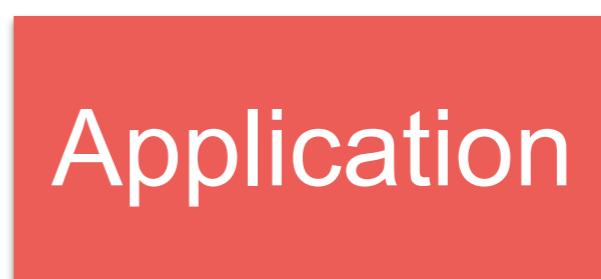


Working with Database

Production



Testing



Initial database 1

Using @PostConstruct

```
@PostConstruct  
public void initData() {  
    Account account1 = new Account();  
    account1.setAccountId("01");  
    accountRepository.save(account1);  
    Account account2 = new Account();  
    account2.setAccountId("02");  
    accountRepository.save(account2);  
}
```



Initial database 2

Schema (resources/schema.sql)

Data (resources/data.sql)

Schema.sql

```
CREATE TABLE account(
    id BIGINT AUTO_INCREMENT PRIMARY KEY,
    account_Id VARCHAR(16) NOT NULL UNIQUE,
    mobile_No VARCHAR(10),
    name VARCHAR(50),
    account_Type CHAR(2)
);
```

Data.sql

```
INSERT INTO account (account_Id) VALUES ('01');
INSERT INTO account (account_Id) VALUES ('02');
```



Initial database 2

Disable auto generate DDL from JPA in file application.yml

```
spring:  
  jpa:  
    show-sql: true  
    hibernate:  
      ddl-auto: none
```



Initial database 2

Problem with naming strategy !!

```
spring:  
  jpa:  
    show-sql: true  
    hibernate:  
      ddl-auto: none  
      naming:  
        physical-strategy:  
          org.springframework.boot.orm.jpa.hibernate.SpringPhysicalNamingStrategy  
        implicit-strategy:  
          org.springframework.boot.orm.jpa.hibernate.SpringImplicitNamingStrategy
```

<https://github.com/spring-projects/spring-boot/tree/master/spring-boot-project/spring-boot/src/main/java/org/springframework/boot/orm/jpa/hibernate>



Run and see from logging

Execute file schema.sql and data.sql

```
o.s.jdbc.datasource.init.ScriptUtils      : Executing SQL script from URL [file:/Users/somkiat/dat
o.s.jdbc.datasource.init.ScriptUtils      : Executed SQL script from URL [file:/Users/somkiat/data
49 ms.
o.s.jdbc.datasource.init.ScriptUtils      : Executing SQL script from URL [file:/Users/somkiat/dat
o.s.jdbc.datasource.init.ScriptUtils      : Executed SQL script from URL [file:/Users/somkiat/data
ms.
```



Run service

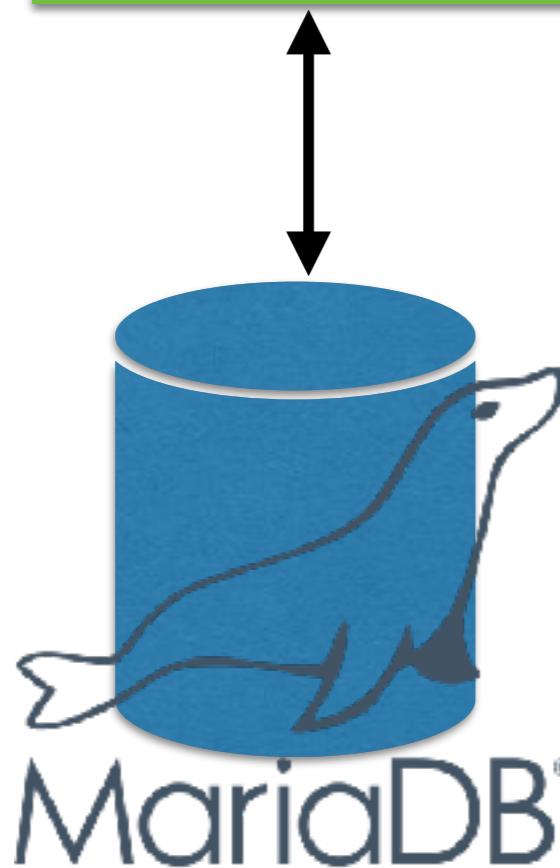
http://localhost:8080/account/0868696209

```
← → ⌂ ⓘ localhost:8080/account/0868696209
[
  - {
    accountNo: "01",
    mobileNo: null,
    name: "",
    accountType: ""
  },
  - {
    accountNo: "02",
    mobileNo: null,
    name: "",
    accountType: ""
  }
]
```

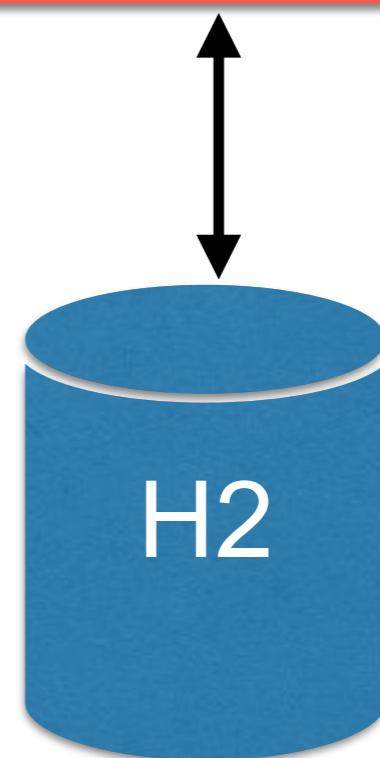
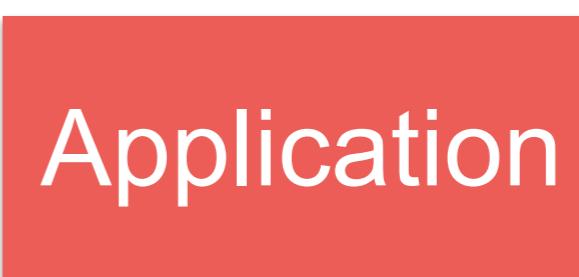


Working with Database

Production



Testing



Add database dependency

In file pom.xml

```
<dependency>
    <groupId>org.mariadb.jdbc</groupId>
    <artifactId>mariadb-java-client</artifactId>
    <version>2.2.5</version>
</dependency>
```

<https://mariadb.com/kb/en/library/about-mariadb-connector-j/>



Config database in application

In file resources/application.yml

```
spring:
  datasource:
    driver-class-name: org.mariadb.jdbc.Driver
    url: jdbc:mariadb://35.198.254.195:3306/account
    username: user01
    password: password

    initialization-mode: always
    testWhileIdle: true
    validationQuery: SELECT 1

  jpa:
    show-sql: true
    properties:
      hibernate:
        dialect: org.hibernate.dialect.MySQL5InnoDBDialect
```



Config database in application

Required config for database

```
spring:
```

```
  datasource:  
    driver-class-name: org.mariadb.jdbc.Driver  
    url: jdbc:mariadb://35.198.254.195:3306/account  
    username: user01  
    password: password
```

```
    initialization-mode: always
```

```
    testWhileIdle: true
```

```
    validationQuery: SELECT 1
```

```
jpa:
```

```
  show-sql: true
```

```
  properties:
```

```
    hibernate:
```

```
      dialect: org.hibernate.dialect.MySQL5InnoDBDialect
```



Config database in application

Required config for database

```
spring:  
  datasource:  
    driver-class-name: org.mariadb.jdbc.Driver  
    url: jdbc:mariadb://35.198.254.195:3306/account  
    username: user01  
    password: password
```

```
  initialization-mode: always
```

```
  testWhileIdle: true  
  validationQuery: SELECT 1  
  
  jpa:  
    show-sql: true  
    properties:  
      hibernate:  
        dialect: org.hibernate.dialect.MySQL5InnoDBDialect
```

By default not run



Run service

http://localhost:8080/account/0868696209

```
← → ⌂ ⓘ localhost:8080/account/0868696209
[
  - {
    accountNo: "01",
    mobileNo: null,
    name: "",
    accountType: ""
  },
  - {
    accountNo: "02",
    mobileNo: null,
    name: "",
    accountType: ""
  }
]
```



Check your test ?

\$mvnw clean test



Step to test

Stop the real database before run test

See result



Error ?

Spring boot try to connect to the real database ?



Fix Error

Create file /resources/application.yml in test folder

spring: **config of H2 database**

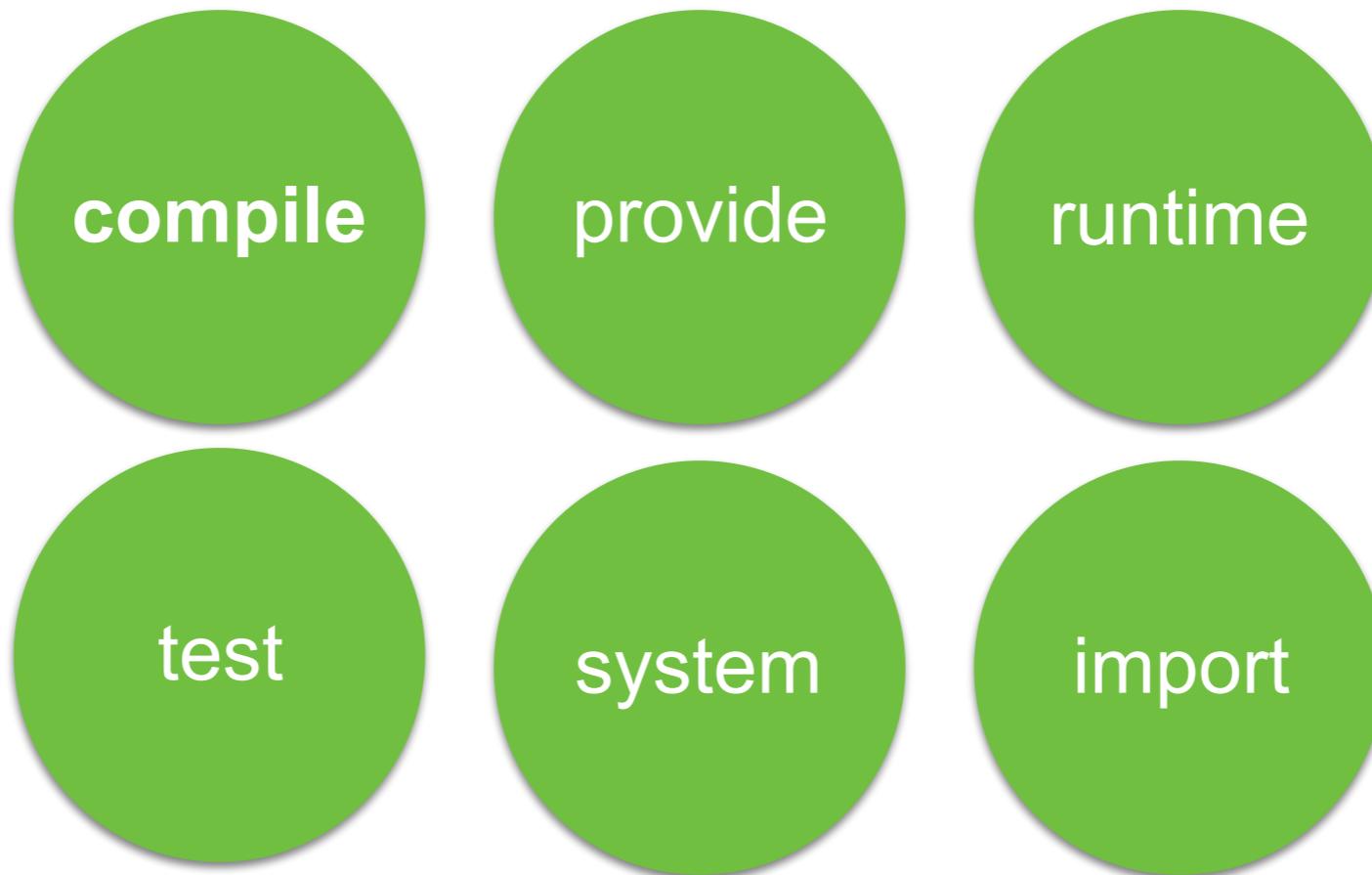
```
datasource:  
  driver-class-name: org.h2.Driver  
  url: jdbc:h2:mem:db;DB_CLOSE_DELAY=-1  
  username: sa  
  password: sa
```

```
jpa:  
  show-sql: true  
  properties:  
    hibernate:  
      dialect: org.hibernate.dialect.H2Dialect
```



Question ?

Dependency Scopes in file pom.xml
runtime ?



https://maven.apache.org/guides/introduction/introduction-to-dependency-mechanism.html#Dependency_Scope



Question ?

show_sql=true not working ?

```
jpa:  
  show_sql: true  
  hibernate:  
    ddl-auto: none  
  properties:  
    hibernate:  
      format_sql: true  
    dialect: org.hibernate.dialect.MySQL5InnoDBDialect
```

```
logging:  
  level:  
    org.hibernate.SQL: DEBUG
```

Beautiful sql format
Default log level = INFO



Log Levels

Level	Color
FATAL	Red
ERROR	Red
WARN	Yellow
INFO (default)	Green
DEBUG	Green
TRACE	Green

<https://docs.spring.io/spring-boot/docs/current/reference/html/boot-features-logging.html>



Testing with Mocking



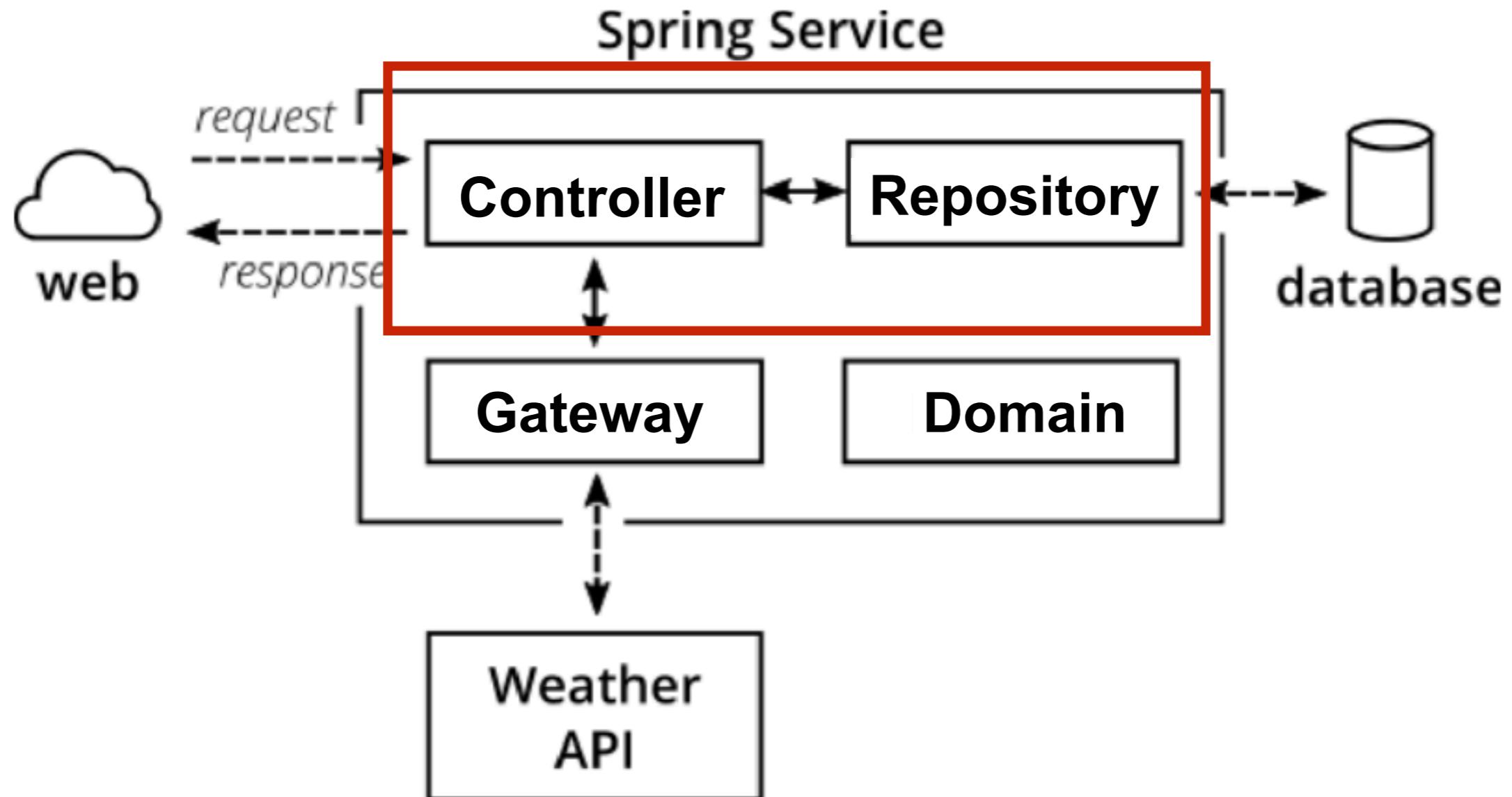
Controller/Service Testing

Unit testing ?

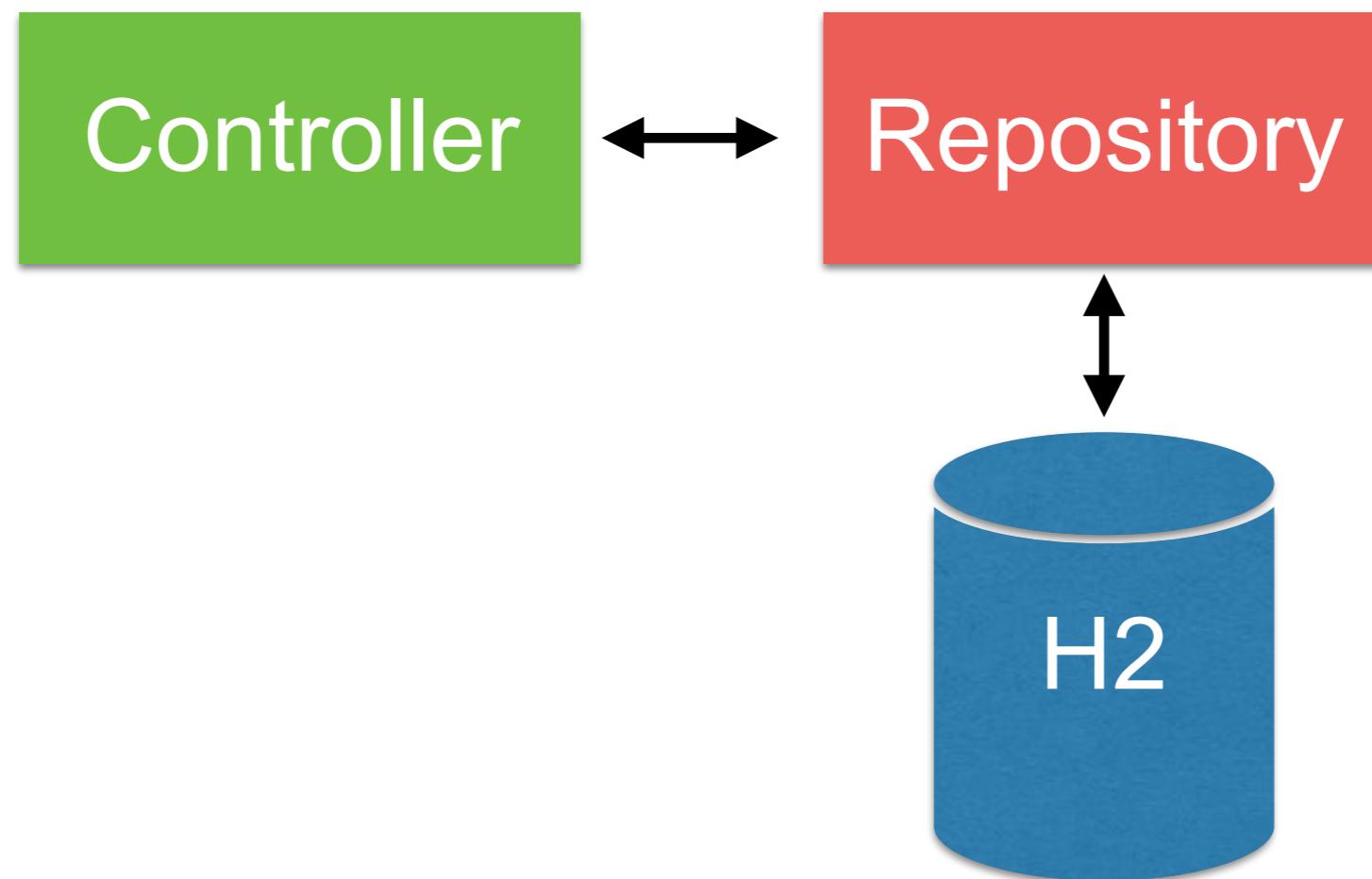
Spring Unit testing with MockMvc ?



Controller Testing with Unit test



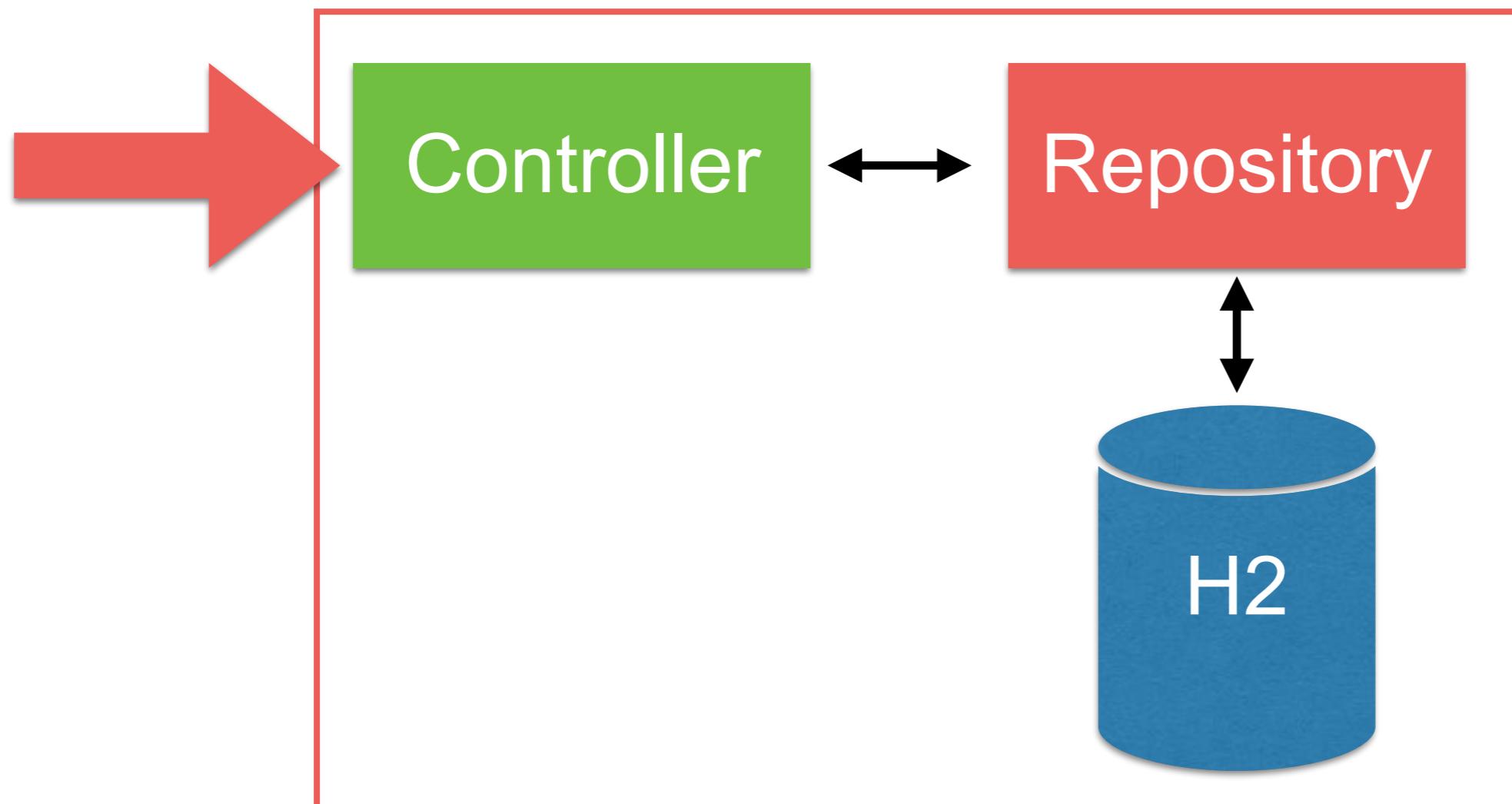
Controller Testing



Controller Testing

Using `@SpringBootTest`

Spring Testing



Unit test

Use Test Double

In java, use Mockito library



<http://site.mockito.org/>



Unit test with Mockito (1)

```
public class HelloControllerWithRepositoryTest {  
  
    private HelloControllerWithRepository controllerWithRepository;  
  
    @Mock  
    private PersonRepository personRepository;  
  
    @Before  
    public void init() {  
        initMocks(testClass: this);  
        controllerWithRepository  
            = new HelloControllerWithRepository(personRepository);  
    }  
}
```



Unit test with Mockito (2)

```
@Test
public void shouldReturnHelloSomkiat() {
    //Arrange
    Person somkiat = new Person("somkiat", "pui");
    given(personRepository.findByName("somkiat"))
        .willReturn(Optional.of(somkiat));

    // Action
    Hello hello = controllerWithRepository.sayHi( name: "somkiat");

    // Assert
    assertEquals( expected: "Hello somkiat", hello.getMessage());
}
```



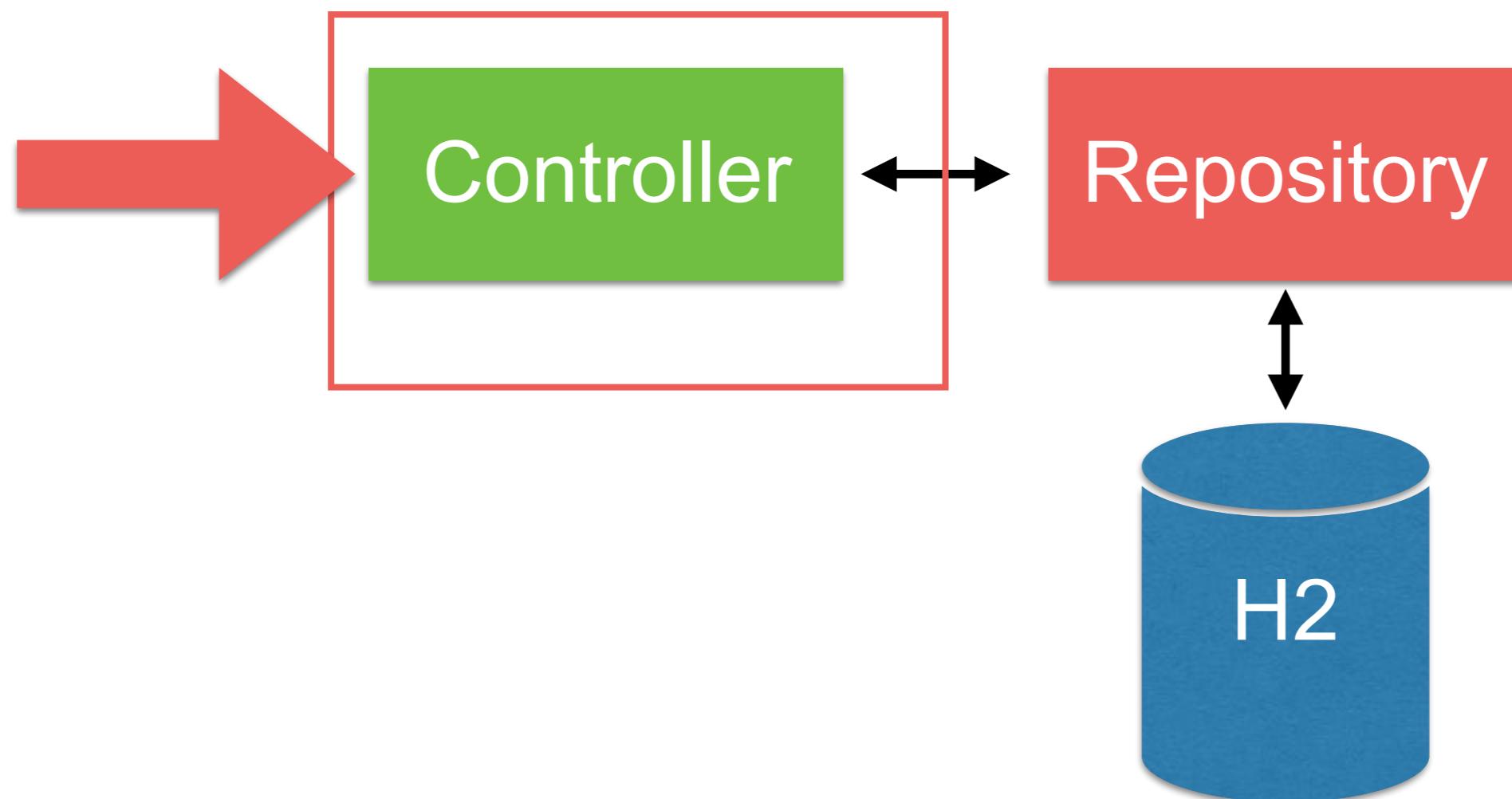
Try by yourself



Controller Testing with mock

Using `@SpringBootTest`

Spring Testing



Controller Testing with mock (1)

```
@RunWith(SpringRunner.class)
@SpringBootTest(
    webEnvironment = WebEnvironment.RANDOM_PORT)
public class AccountControllerMockTest {

    @Autowired
    private TestRestTemplate testRestTemplate;

    @MockBean
    private AccountRepository accountRepository;
```



Controller Testing with mock (2)

```
@Test  
public void เรียกข้อมูลบัญชีของหมายเลข_0868696209_ต้องเจอสองบัญชีนั่น()  
{  
    // Arrange  
    List<Account> accountIterable = new ArrayList<>();  
    accountIterable.add(new Account("01"));  
    accountIterable.add(new Account("02"));  
    given(accountRepository.findAll()).willReturn(accountIterable);  
  
    // Act  
    List<AccountResponse> accountResponses  
        = testRestTemplate.getForObject(  
            "/account/0868696209", List.class);  
  
    // Assert  
    assertEquals(2, accountResponses.size());  
}
```



Controller Testing with mock (3)

```
@Test
public void
    เรียกข้อมูลบัญชีของหมายเลข_0868696209_ต้องเจอสองบัญชีนั่น() {
        // Arrange
        List<Account> accountIterable = new ArrayList<>();
        accountIterable.add(new Account("01"));
        accountIterable.add(new Account("02"));
        given(accountRepository.findAll()).willReturn(accountIterable);

        // Act
        List<AccountResponse> accountResponses
            = testRestTemplate.getForObject(
                "/account/0868696209", List.class);

        // Assert
        assertEquals(2, accountResponses.size());
    }
```

Call service with rest template



Coverage report

Packages

All
[toystore](#)
[toystore.controller](#)
[toystore.domain](#)
[toystore.repository](#)

Coverage Report - All Packages

Package	# Classes	Line Coverage	Branch Coverage	Complexity
All Packages	6	90% 25/28	50% 1/2	1.1
toystore	1	33% 1/3	N/A	1
toystore.controller	2	93% 15/16	50% 1/2	2
toystore.domain	1	100% 4/4	N/A	1
toystore.repository	2	100% 9/9	N/A	1

Report generated by [Cobertura](#) 2.1.1 on 3/6/18 5:20 PM.

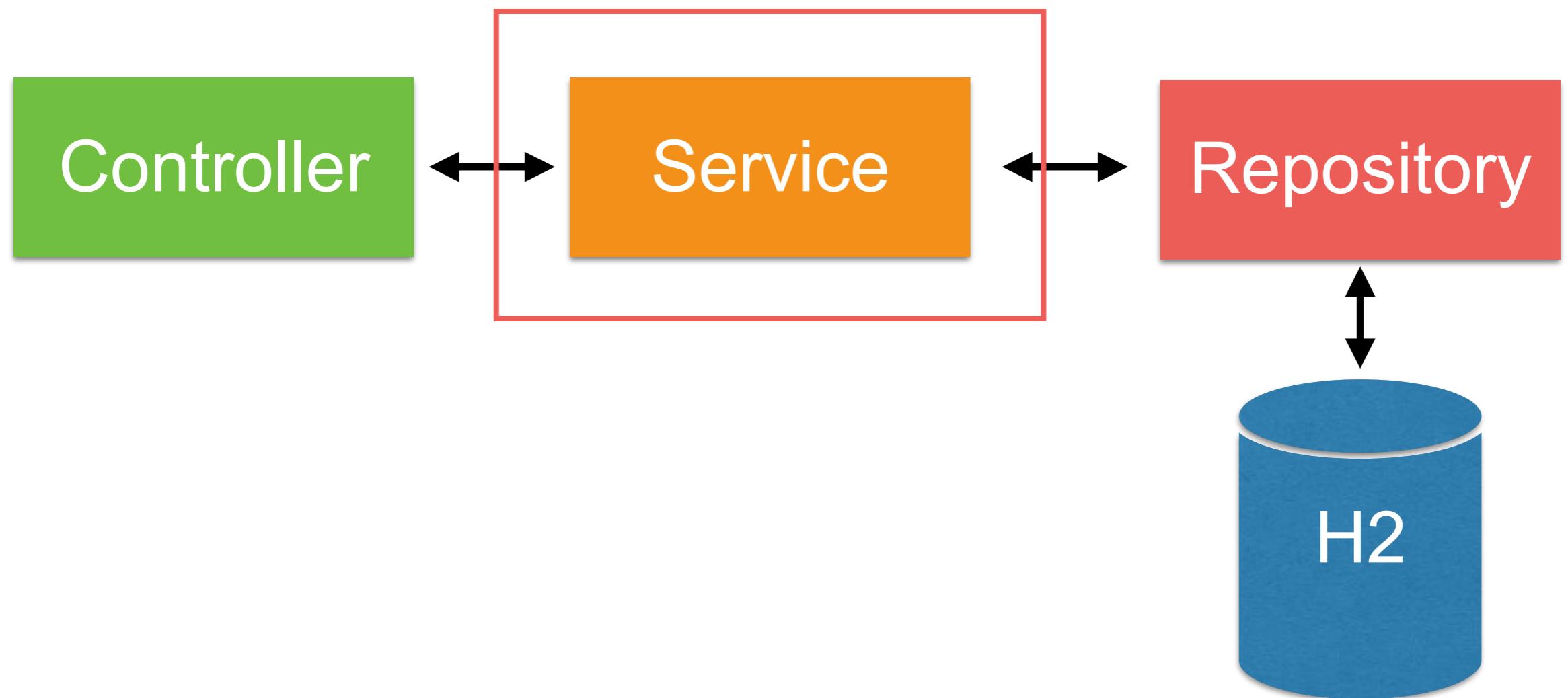
All Packages

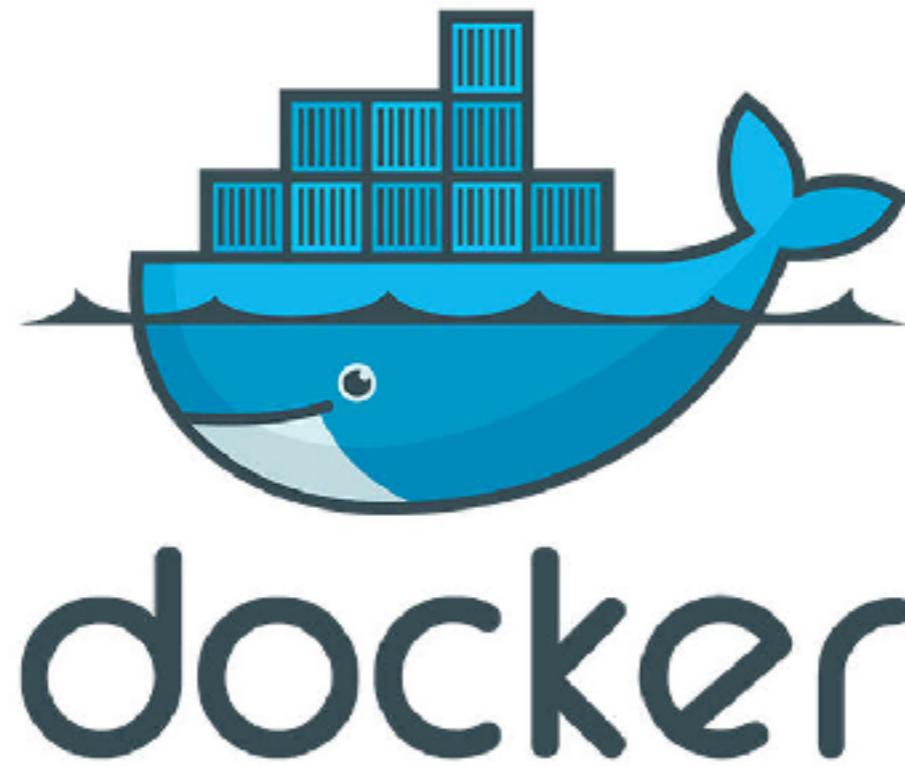
Classes

[Hello](#) (100%)
[HelloController](#) (83%)
[HelloWithRepositoryController](#) (100%)
[Person](#) (100%)
[PersonRepository](#) (N/A)
[ToyStoreApplication](#) (33%)



Controller Testing with Unit test



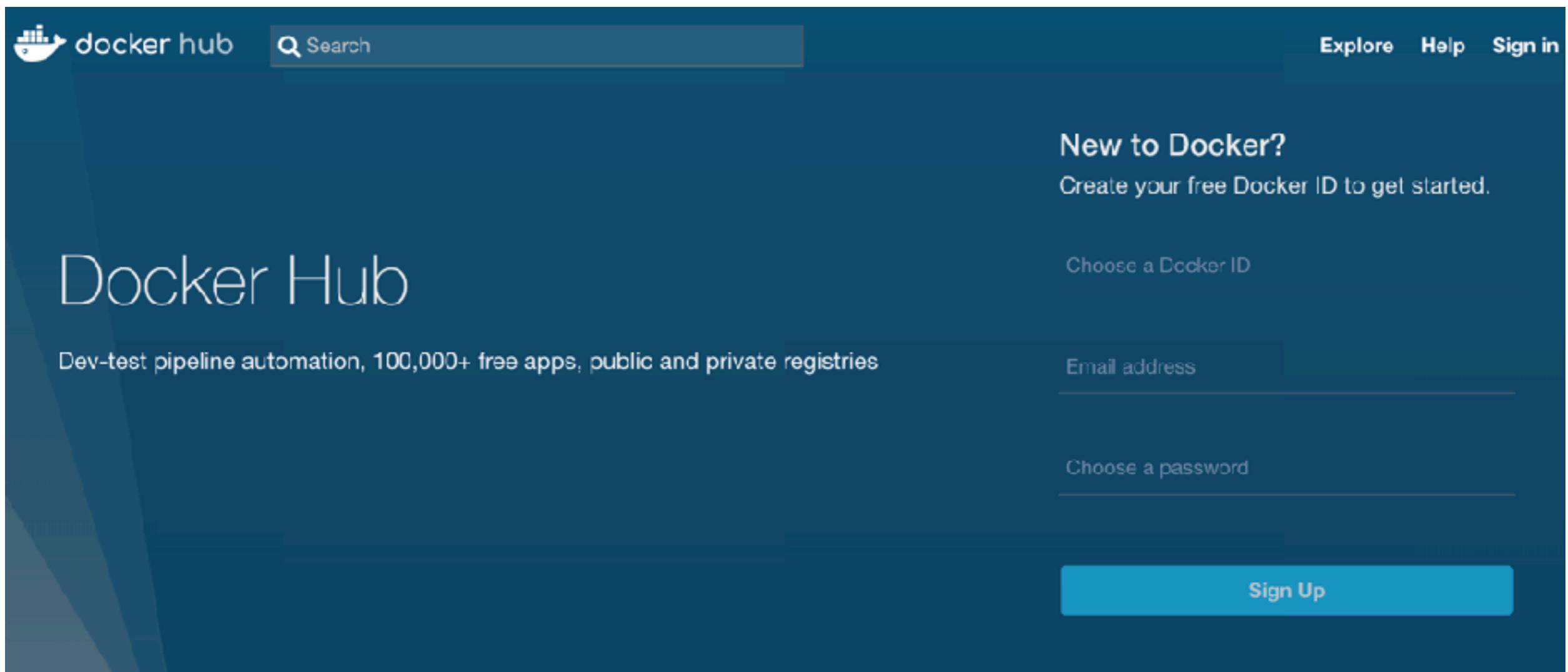


Working with container



Choose your image

from hub.docker.com



The screenshot shows the Docker Hub sign-up page. At the top left is the Docker Hub logo and a search bar. To the right are links for "Explore", "Help", and "Sign in". The main heading "Docker Hub" is on the left, followed by a subtext about pipeline automation and registries. On the right, there's a "New to Docker?" section with a "Create your free Docker ID to get started." link, a "Choose a Docker ID" input field, an "Email address" input field, a "Choose a password" input field, and a prominent blue "Sign Up" button.



Images in workshop

Java => OpenJDK

Apache Maven => maven

PostgreSQL => progrès



Java => OpenJDK

OFFICIAL REPOSITORY

openjdk 

Last pushed: 5 days ago

[Repo Info](#) [Tags](#)

Short Description

OpenJDK is an open-source implementation of the Java Platform, Standard Edition

Docker Pull Command

`docker pull openjdk`

Full Description

Supported tags and respective [Dockerfile](#) [links](#)

Simple Tags

- `10-ea-32-jre-experimental`, `10-ea-jre-experimental`, `10-jre-`

https://hub.docker.com/_/openjdk/



Apache Maven => maven

OFFICIAL REPOSITORY

maven 

Last pushed: 5 days ago

Repo Info [Tags](#)

Short Description

Apache Maven is a software project management and comprehension tool.

Docker Pull Command



`docker pull maven`

Full Description

Supported tags and respective [Dockerfile](#) links

- `3.5.2-jdk-7-alpine` ([jdk-7-alpine/Dockerfile](#))
- `3.5.2-jdk-7-slim` ([jdk-7-slim/Dockerfile](#))
- `3.5.2-slim` ([slim/Dockerfile](#))

https://hub.docker.com/_/maven/



PostgreSQL => progrès

OFFICIAL REPOSITORY

postgres 

Last pushed: 3 days ago

Repo Info Tags

Short Description

The PostgreSQL object-relational database system provides reliability and data integrity.

Docker Pull Command

```
docker pull postgres
```

Full Description

Supported tags and respective [Dockerfile](#) links

- [10.3](#), [10](#), [latest](#) ([10/Dockerfile](#))
[10.3](#) → [10.3/Dockerfile](#) → [10/Dockerfile](#) → [latest/Dockerfile](#)

https://hub.docker.com/_/postgres/



Pull images from Docker Hub

\$docker image pull openjdk:<tag>

\$docker image pull maven:<tag>

\$docker image pull postgres:<tag>



Create container to run Spring Boot



Create container to run Spring Boot

```
$docker container run -d  
-v $(pwd)/target/toystore.jar:/xxx/toystore.jar  
-p 8080:8080  
--name web  
openjdk:8-jre java -jar /xxx/toystore.jar
```



Create new Docker image (1)

from Dockerfile

```
FROM openjdk:8-jre  
COPY ./target/toystore.jar /xxx/toystore.jar  
CMD java -jar /xxx/toystore.jar
```



Create new Docker image (2)

Build image from Dockerfile

```
$ docker image build -t toystore:0.1 .
```

```
Sending build context to Docker daemon 33.47MB
```

```
Step 1/3 : FROM openjdk:8-jre
```

```
---> e956268fd4ed
```

```
Step 2/3 : COPY ./target/toystore.jar /xxx/toystore.jar
```

```
---> 3dd837b158eb
```

```
Step 3/3 : CMD java -jar /xxx/toystore.jar
```

```
---> Running in 06994b290e74
```

```
Removing intermediate container 06994b290e74
```

```
---> 0bc2054f4ba8
```

```
Successfully built 0bc2054f4ba8
```

```
Successfully tagged toystore:0.1
```



Create container to run Spring Boot

```
$ docker container run -d -p 8080:8080 toystore:0.1
```

```
$ docker container run -d -p 8081:8080 toystore:0.1
```

```
$ docker container run -d -p 8082:8080 toystore:0.1
```



Create container to run Build Maven Project



Create container to build

```
$docker container run --rm  
-v $(pwd):/xxx  
-w /xxx  
maven:3.5.2-alpine mvn clean package
```



Run your application

```
$java -jar target/hello.jar
```



Create container of PostgreSQL



Create container of PostgreSQL

```
$ docker container run  
-p 15432:5432  
-e POSTGRES_USER=user  
-e POSTGRES_PASSWORD=password  
postgres:10.3-alpine
```



Run your application again !!

\$java -jar target/hello.jar

```
Hibernate: create sequence hibernate_sequence start 1 increment 1
Hibernate: create table person (id int4 not null, first_name varchar(255), last_name varchar(255), primary key (id))
2018-03-06 19:45:41.115  INFO 56495 --- [           main] o.h.t.schema.internal.SchemaCreatorImpl : HHH000476: Executing import script 'org.hibernate.tool.schema.internal.exec.ScriptSourceInputNonExistentImpl@7e998ed7'
2018-03-06 19:45:41.121  INFO 56495 --- [           main] j.LocalContainerEntityManagerFactoryBean : Initialized JPA EntityManagerFactory for persistence unit 'default'
2018-03-06 19:45:42.592  INFO 56495 --- [           main] s.w.s.m.m.a.RequestMappingHandlerAdapter : Looking for @ControllerAdvice: org.springframework.boot.web.servlet.context.AnnotationConfigServletWebServerApplicationContext@7cef4e59: startup date [Tue Mar 06 19:45:34 ICT 2018]; root of context hierarchy
2018-03-06 19:45:42.716  WARN 56495 --- [           main] aWebConfigurationJpaWebMvcConfiguration : spring.jpa.open-in-view is enabled by default. Therefore, database queries may be performed during view rendering. Explicitly configure spring.jpa.open-in-view to disable this warning
2018-03-06 19:45:42.857  INFO 56495 --- [           main] s.w.s.m.m.a.RequestMappingHandlerMapping : Mapped "{[/hello/{name}],methods=[GET]}" onto public toystore.domain.Hello toystore.controller.HelloController.sayHi(java.lang.String)
2018-03-06 19:45:42.881  INFO 56495 --- [           main] s.w.s.m.m.a.RequestMappingHandlerMapping : Mapped "{[/hello/data/{name}],methods=[GET]}" onto public toystore.domain.Hello toystore.controller.HelloWithRepositoryController.sayHi(java.lang.String)
2018-03-06 19:45:42.889  INFO 56495 --- [           main] s.w.s.m.m.a.RequestMappingHandlerMapping : Mapped "{[/error]}" onto public org.springframework.http.ResponseEntity<java.util.Map<java.lang.String, java.lang.Object>> org.springframework.boot.autoconfigure.web.servlet.error.BasicErrorController.error(javax.servlet.http.HttpServletRequest)
2018-03-06 19:45:42.893  INFO 56495 --- [           main] s.w.s.m.m.a.RequestMappingHandlerMapping : Mapped "{[/error],produces=[text/html]}" onto public org.springframework.web.servlet.ModelAndView org.springframework.boot.autoconfigure.web.servlet.error.BasicErrorController.errorHtml(javax.servlet.http.HttpServletRequest,javax.servlet.http.HttpServletResponse)
2018-03-06 19:45:43.046  INFO 56495 --- [           main] o.s.w.s.handler.SimpleUrlHandlerMapping : Mapped URL path [/webjars/**] onto handler of type [class org.springframework.web.servlet.resource.ResourceHttpRequestHandler]
2018-03-06 19:45:43.046  INFO 56495 --- [           main] o.s.w.s.handler.SimpleUrlHandlerMapping : Mapped URL path [/**] onto handler of type [class org.springframework.web.servlet.resource.ResourceHttpRequestHandler]
2018-03-06 19:45:43.168  INFO 56495 --- [           main] o.s.w.s.handler.SimpleUrlHandlerMapping : Mapped URL path [/favicon.ico] onto handler of type [class org.springframework.web.servlet.resource.ResourceHttpRequestHandler]
2018-03-06 19:45:43.783  INFO 56495 --- [           main] o.s.j.e.a.AnnotationMBeanExporter : Registering beans for JMX exposure on startup
2018-03-06 19:45:43.785  INFO 56495 --- [           main] o.s.j.e.a.AnnotationMBeanExporter : Bean with name 'dataSource' has been autodetected for JMX exposure
2018-03-06 19:45:43.793  INFO 56495 --- [           main] o.s.j.e.a.AnnotationMBeanExporter : Located MBean 'dataSource': registering with JMX server as MBean [com.zaxxer.hikari:name=dataSource,type=HikariDataSource]
2018-03-06 19:45:43.873  INFO 56495 --- [           main] o.s.b.w.embedded.tomcat.TomcatWebServer : Tomcat started on port(s): 8080 (http) with context path ''
2018-03-06 19:45:43.877  INFO 56495 --- [           main] toystore.ToyStoreApplication : Started ToyStoreApplication in 10.18 seconds (JVM running for 10.912)
2018-03-06 19:45:47.875  INFO 56495 --- [nio-8080-exec-1] o.a.c.c.C.[Tomcat].[localhost].[/] : Initializing Spring FrameworkServlet 'dispatcherServlet'
2018-03-06 19:45:47.876  INFO 56495 --- [nio-8080-exec-1] o.s.web.servlet.DispatcherServlet : FrameworkServlet 'dispatcherServlet': initialization started
2018-03-06 19:45:47.917  INFO 56495 --- [nio-8080-exec-1] o.s.web.servlet.DispatcherServlet : FrameworkServlet 'dispatcherServlet': initialization completed in 41 ms
```



Monitoring and Metric



Metric in Spring Boot

Spring Boot Actuator for Spring Boot 1.x
MicroMeter for Spring Boot 2.0



Spring Boot Actuator (1)

Add library to pom.xml

```
<dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-actuator</artifactId>
</dependency>
```



Spring Boot Actuator (2)

Enabled endpoint in application.properties

```
info.app.name=Toy Store
info.app.description=This is my first spring boot application
info.app.version=1.0.0

management.endpoints.web.exposure.include=health,info,metrics,httptrace
```



Spring Boot Actuator (3)

List of endpoints = /actuator/

```
← → ⌂ ⓘ localhost:8080/actuator/  
  
{  
  - _links: {  
    - self: {  
        href: "http://localhost:8080/actuator",  
        templated: false  
      },  
    - health: {  
        href: "http://localhost:8080/actuator/health",  
        templated: false  
      },  
    - info: {  
        href: "http://localhost:8080/actuator/info",  
        templated: false  
      },  
    - metrics-requiredMetricName: {  
        href: "http://localhost:8080/actuator/metrics/{requiredMetricName}",  
        templated: true  
      },  
    - metrics: {  
        href: "http://localhost:8080/actuator/metrics",  
        templated: false  
      },  
    - httptrace: {  
        href: "http://localhost:8080/actuator/httptrace",  
        templated: false  
      }  
  }  
}
```



Spring Boot Actuator (4)

Info endpoint = /actuator/info

```
← → ⌂ ⓘ localhost:8080/actuator/info

{
  - app: {
      name: "Toy Store",
      description: "This is my first spring boot application",
      version: "1.0.0"
    }
}
```



Spring Boot Actuator (5)

Info endpoint = /actuator/info

```
← → ⌂ ⓘ localhost:8080/actuator/info

{
  - app: {
      name: "Toy Store",
      description: "This is my first spring boot application",
      version: "1.0.0"
    }
}
```



Spring Boot Actuator (6)

Info endpoint = /actuator/httptrace

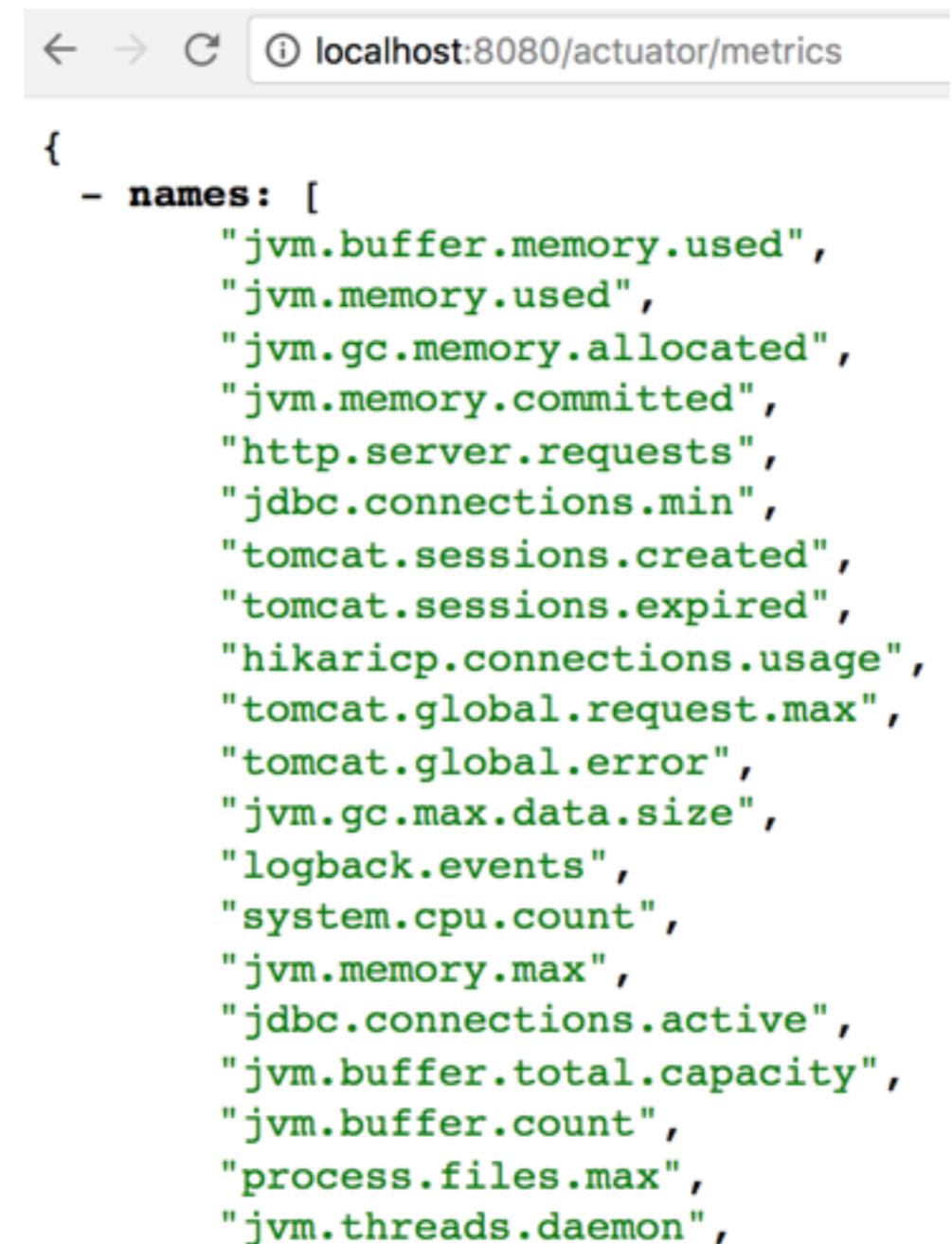
```
← → ⌂ ⓘ localhost:8080/actuator/httptrace

{
  - traces: [
    - {
      timestamp: "2018-03-06T13:33:02.800Z",
      principal: null,
      session: null,
      - request: {
        method: "GET",
        uri: "http://localhost:8080/prometheus",
        - headers: {
          - host: [
            "localhost:8080"
          ],
          - user-agent: [
            "Prometheus/2.0.0"
          ],
          - accept: [
            "text/plain;version=0.0.4;q=1,*/*;q=0.1"
          ],
          - accept-encoding: [
            "gzip"
          ],
          - x-prometheus-scrape-timeout-seconds: [
            "5.000000"
          ]
        },
        remoteAddress: null
      },
    }
  ]
}
```



Spring Boot Actuator (7)

List of metrics endpoint = /actuator/metrics



The screenshot shows a browser window with the URL `localhost:8080/actuator/metrics` in the address bar. The page displays a JSON object representing a list of metric names. The JSON structure is as follows:

```
{  
  - names: [  
    "jvm.buffer.memory.used",  
    "jvm.memory.used",  
    "jvm.gc.memory.allocated",  
    "jvm.memory.committed",  
    "http.server.requests",  
    "jdbc.connections.min",  
    "tomcat.sessions.created",  
    "tomcat.sessions.expired",  
    "hikaricp.connections.usage",  
    "tomcat.global.request.max",  
    "tomcat.global.error",  
    "jvm.gc.max.data.size",  
    "logback.events",  
    "system.cpu.count",  
    "jvm.memory.max",  
    "jdbc.connections.active",  
    "jvm.buffer.total.capacity",  
    "jvm.buffer.count",  
    "process.files.max",  
    "jvm.threads.daemon",  
  ]  
}
```



Spring Boot Actuator (8)

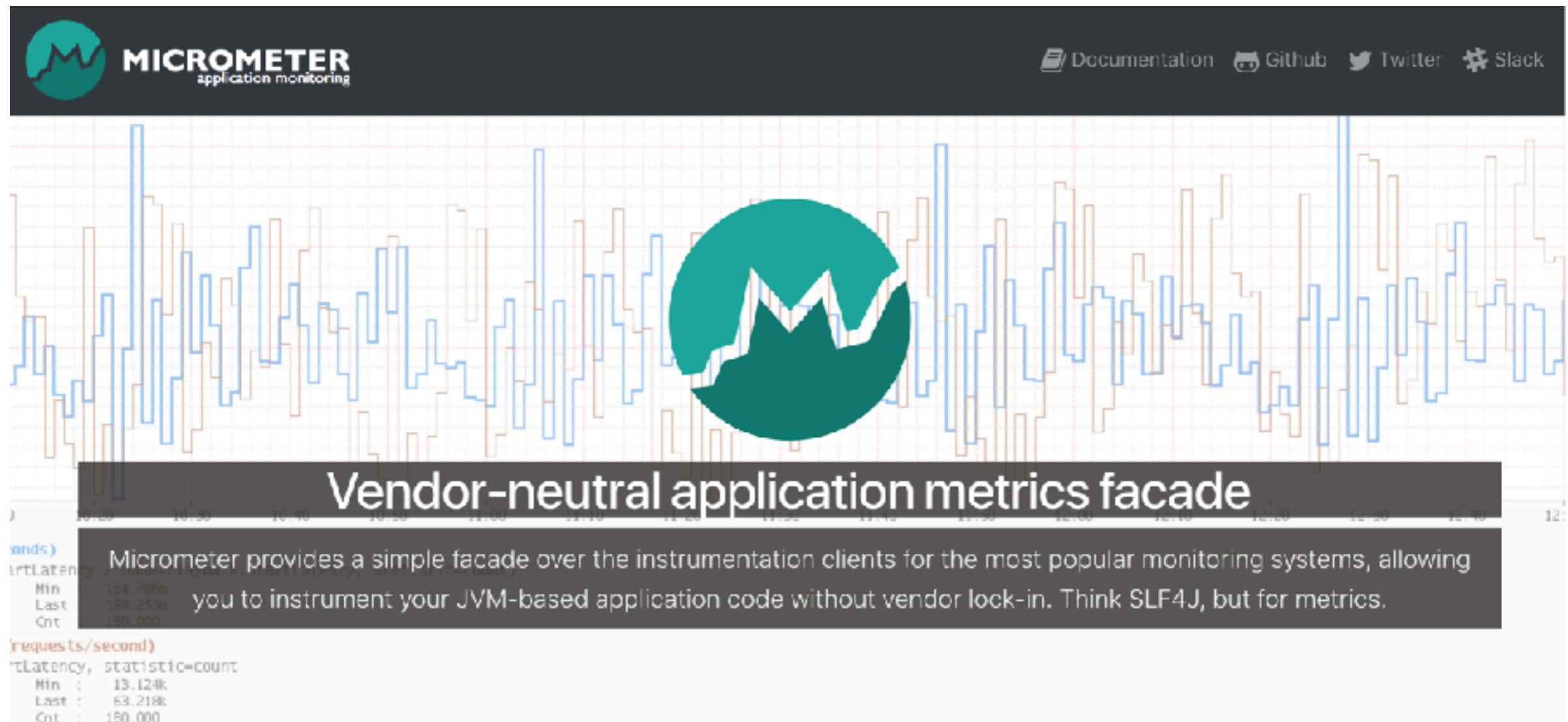
/actuator/metrics/http.server.requests

```
← → ⌂ ⓘ localhost:8080/actuator/metrics/http.server.requests

{
  name: "http.server.requests",
  - measurements: [
    - {
      statistic: "COUNT",
      value: 269
    },
    - {
      statistic: "TOTAL_TIME",
      value: 1.1072010200000002
    },
    - {
      statistic: "MAX",
      value: 0.04373569
    }
  ],
  - availableTags: [
    - {
      tag: "exception",
      - values: [
        "None"
      ]
    },
    - {
      tag: "method",
      - values: [
        "GET"
      ]
    }
  ],
}
```



Spring Boot 2.0 with MicroMeter



<https://micrometer.io/>



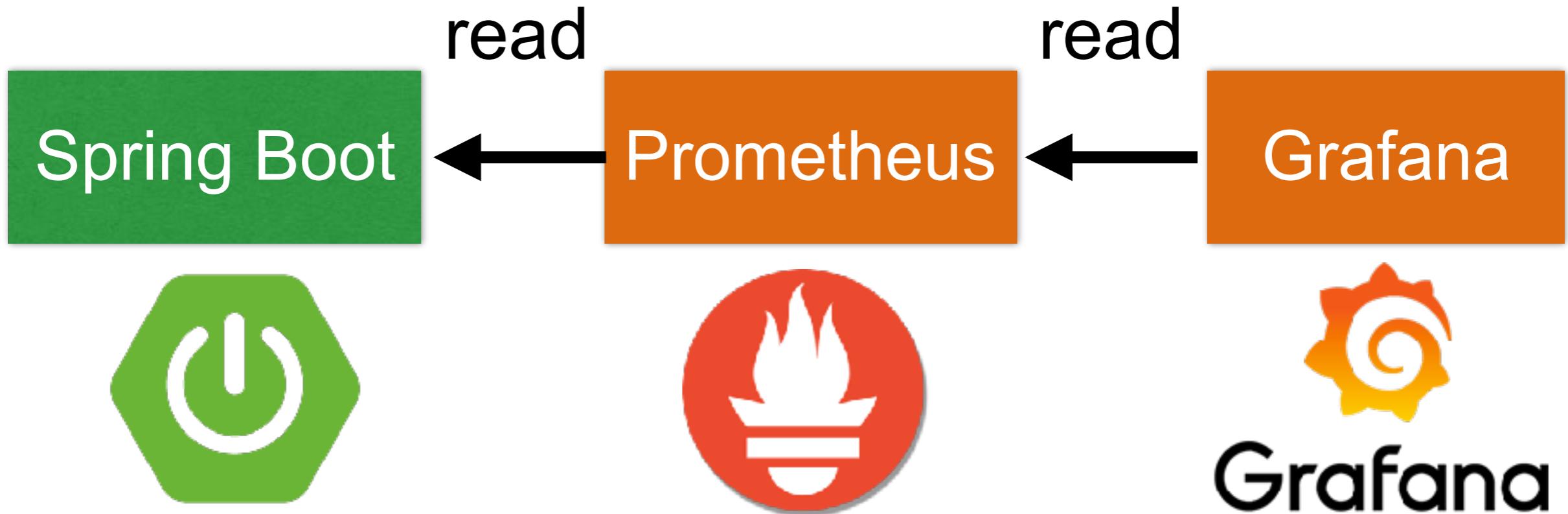
Keep and Visualize Metric of Spring Boot Services



Sample Architecture



Sample Architecture



Service metric for Prometheus



Enable Prometheus (1)

Add library to pom.xml

```
<dependency>
    <groupId>io.micrometer</groupId>
    <artifactId>micrometer-registry-prometheus</artifactId>
    <version>1.0.1</version>
</dependency>
```



Enable Prometheus (2)

Enabled endpoint in application.properties

```
management.endpoints.web.exposure.include  
=....,prometheus
```



Enable Prometheus (3)

New endpoint = actuator/prometheus

```
← → ⌂ ⓘ localhost:8080/actuator/prometheus

# HELP jvm_memory_used_bytes The amount of used memory
# TYPE jvm_memory_used_bytes gauge
jvm_memory_used_bytes{area="nonheap",id="Code Cache",} 1.49056E7
jvm_memory_used_bytes{area="nonheap",id="Metaspace",} 5.6766712E7
jvm_memory_used_bytes{area="nonheap",id="Compressed Class Space",} 7617096.0
jvm_memory_used_bytes{area="heap",id="PS Eden Space",} 1.7135864E7
jvm_memory_used_bytes{area="heap",id="PS Survivor Space",} 1.6235192E7
jvm_memory_used_bytes{area="heap",id="PS Old Gen",} 2.1936456E7
# HELP hikaricp_connections_idle Idle connections
# TYPE hikaricp_connections_idle gauge
hikaricp_connections_idle{pool="HikariPool-1",} NaN
# HELP tomcat_threads_config_max
# TYPE tomcat_threads_config_max gauge
tomcat_threads_config_max{name="http-nio-8080",} 200.0
# HELP tomcat_servlet_error_total
# TYPE tomcat_servlet_error_total counter
tomcat_servlet_error_total{name="default",} 0.0
# HELP jvm_threads_peak The peak live thread count since the Java virtual machine start
# TYPE jvm_threads_peak gauge
jvm_threads_peak 28.0
# HELP hikaricp_connections_pending Pending threads
# TYPE hikaricp_connections_pending gauge
hikaricp_connections_pending{pool="HikariPool-1",} NaN
# HELP system_cpu_count The number of processors available to the Java virtual machine
```



Keep data in Prometheus

<https://prometheus.io/>



Prometheus



Prometheus

DOCS

DOWNLOAD

COMMUNITY

BLOG



From metrics to insight

Power your metrics and alerting with a leading
open-source monitoring solution.

GET STARTED

DOWNLOAD

Prometheus v2.0 is available now — [Read the announcement blog post!](#)

<https://prometheus.io/>



Java Framework
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Prometheus

PUBLIC | AUTOMATED BUILD

[prom/prometheus](#) 

Last pushed: 17 hours ago

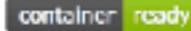
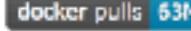
[Repo Info](#) [Tags](#) [Dockerfile](#) [Build Details](#)

Short Description

Short description is empty for this repo.

Full Description

Prometheus 

 

 63M

Visit prometheus.io for the full documentation, examples and guides.

Prometheus is a systems and service monitoring system. It collects metrics

Docker Pull Command

`docker pull prom/prometheus`

Owner



prom

Source Repository

 [prometheus/prometheus](#)

<https://hub.docker.com/r/prom/prometheus/>



Create container of Prometheus

```
$ docker container run --rm  
  -p 9090:9090  
  -v $(pwd)/prometheus.yml:/etc/prometheus/  
prometheus.yml  
  --name monitor prom/prometheus
```



Check Data in Prometheus

http://localhost:9090/

The screenshot shows the Prometheus web interface at the URL `http://localhost:9090/graph`. The interface has a dark header bar with navigation icons and the URL. Below the header is a navigation menu with links for Prometheus, Alerts, Graph, Status, and Help. A checkbox labeled "Enable query history" is checked. A text input field for "Expression" contains the placeholder "- insert metric at cursor -". Below the expression input are two tabs: "Graph" (which is selected) and "Console". A table below the tabs shows one row with the "Element" column containing "no data" and the "Value" column being empty. At the bottom left is a blue button labeled "Add Graph".



Check Target in Prometheus

Status -> Targets

The screenshot shows the Prometheus web interface at the URL `localhost:9090/targets`. The top navigation bar includes links for Prometheus, Alerts, Graph, Status, and Help. The main title is "Targets". A checkbox labeled "Only unhealthy jobs" is unchecked. Below this, a section titled "spring-boot (1/1 up)" contains a "show less" button. A table lists one target endpoint:

Endpoint	State	Labels	Last Scrape	Error
http://10.10.99.59:8080/actuator/prometheus	UP	instance="10.10.99.59:8080"	2.355s ago	



Show data in Grafana

<https://grafana.com/>



Grafana

The open platform for beautiful analytics and monitoring

APP
Grafana TestData
By Grafana Project

APP
kubernetes
By Raintank Inc.

APP
Kentik Connect Pro

APP
NS1 for Grafana
By NS1.

Get Grafana

The leading open source software for time series analytics

Grafana

<https://grafana.com/>



Grafana

PUBLIC REPOSITORY

[grafana/grafana](#) 

Last pushed: 25 minutes ago

[Repo Info](#) [Tags](#)

Short Description

The official Grafana docker container

Full Description

[Grafana Docker image](#)

This project builds a Docker image with the latest master build of Grafana.

[Running your Grafana container](#)

Start your container binding the external port 3000 .

```
docker run -d --name=grafana -p 3000:3000 grafana/grafana
```

Docker Pull Command

```
docker pull grafana/grafana
```

Owner



grafana

<https://hub.docker.com/r/grafana/grafana/>



Create container of Grafana

```
$docker container run  
--name=grafana  
-p 3000:3000 grafana/grafana
```



Grafana Dashboard

<https://grafana.com/dashboards/4701>

All dashboards » **JVM (Micrometer)**



JVM (Micrometer) by [mweirauch](#)

[DASHBOARD](#)

Dashboard for Micrometer instrumented applications (Java, Spring Boot)
Last updated: 21 days ago

[Overview](#) [Revisions](#)



Get this dashboard:

[4701](#) [Copy ID to Clipboard](#)

A dashboard for **Micrometer** instrumented applications (Java, Spring Boot).

Features

- JVM memory
- Process memory (provided by `micrometer-jvm-extras`)
- CPU-Usage, Load, Threads, File Descriptors, Log Events
- JVM Memory Pools (Heap, Non-Heap)
- Garbage Collection

Dependencies:

 **GRAFANA 4.6.3**

 **GRAPH**



Take to your home

Always improve, always practice



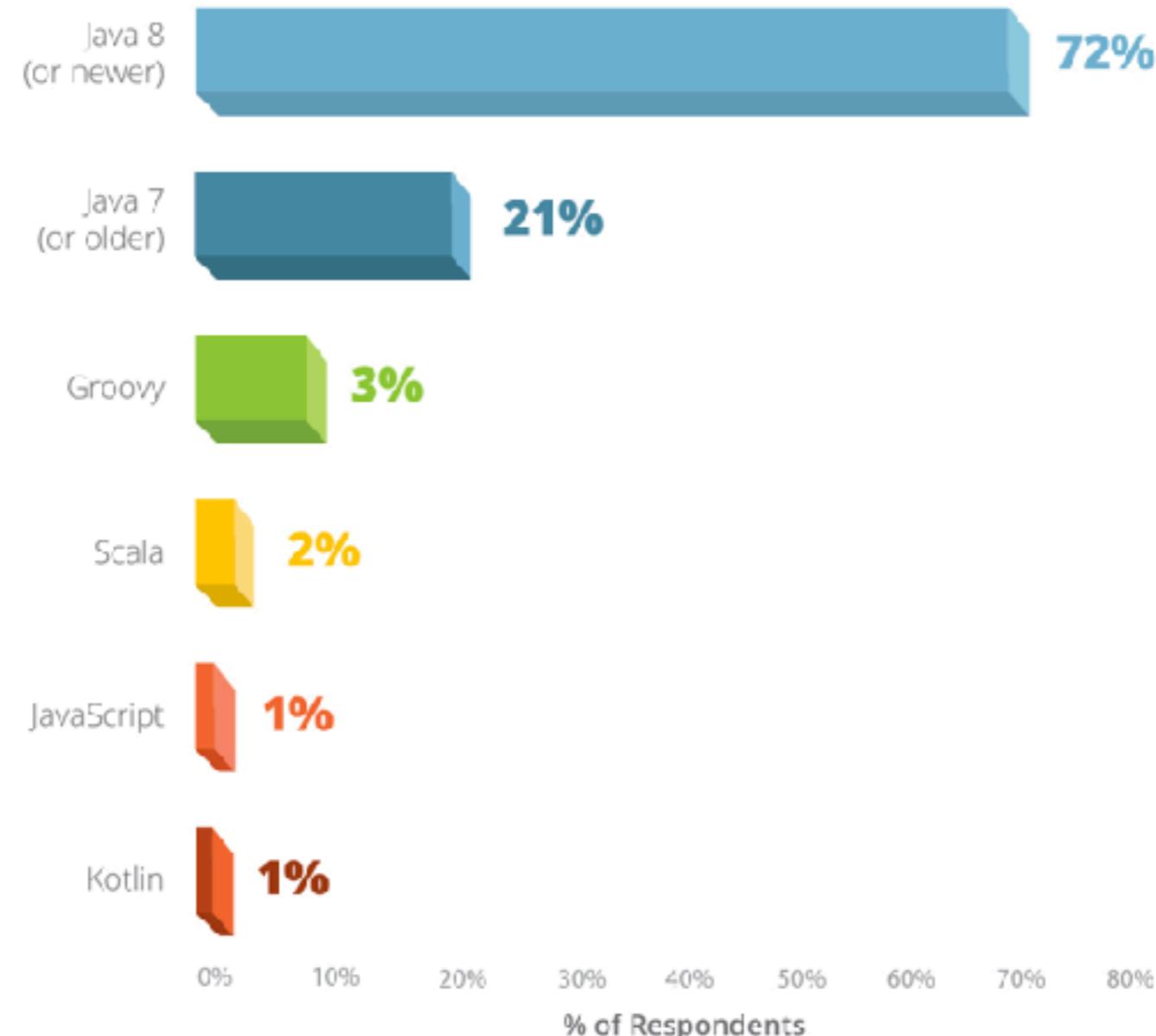
Developer productivity report

<https://zeroturnaround.com/>



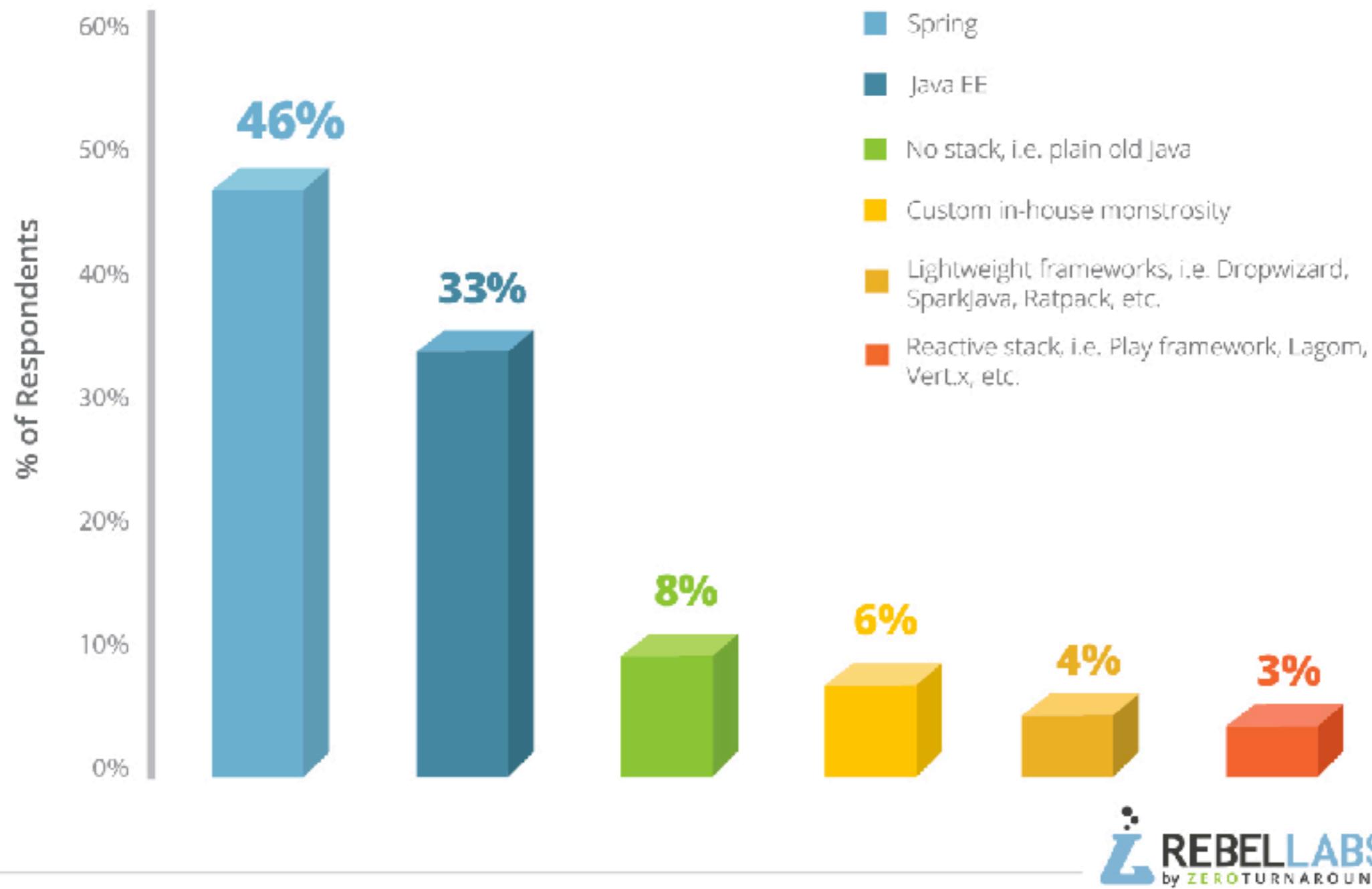
JVM languages

Plain old Java **dominates the language preference**



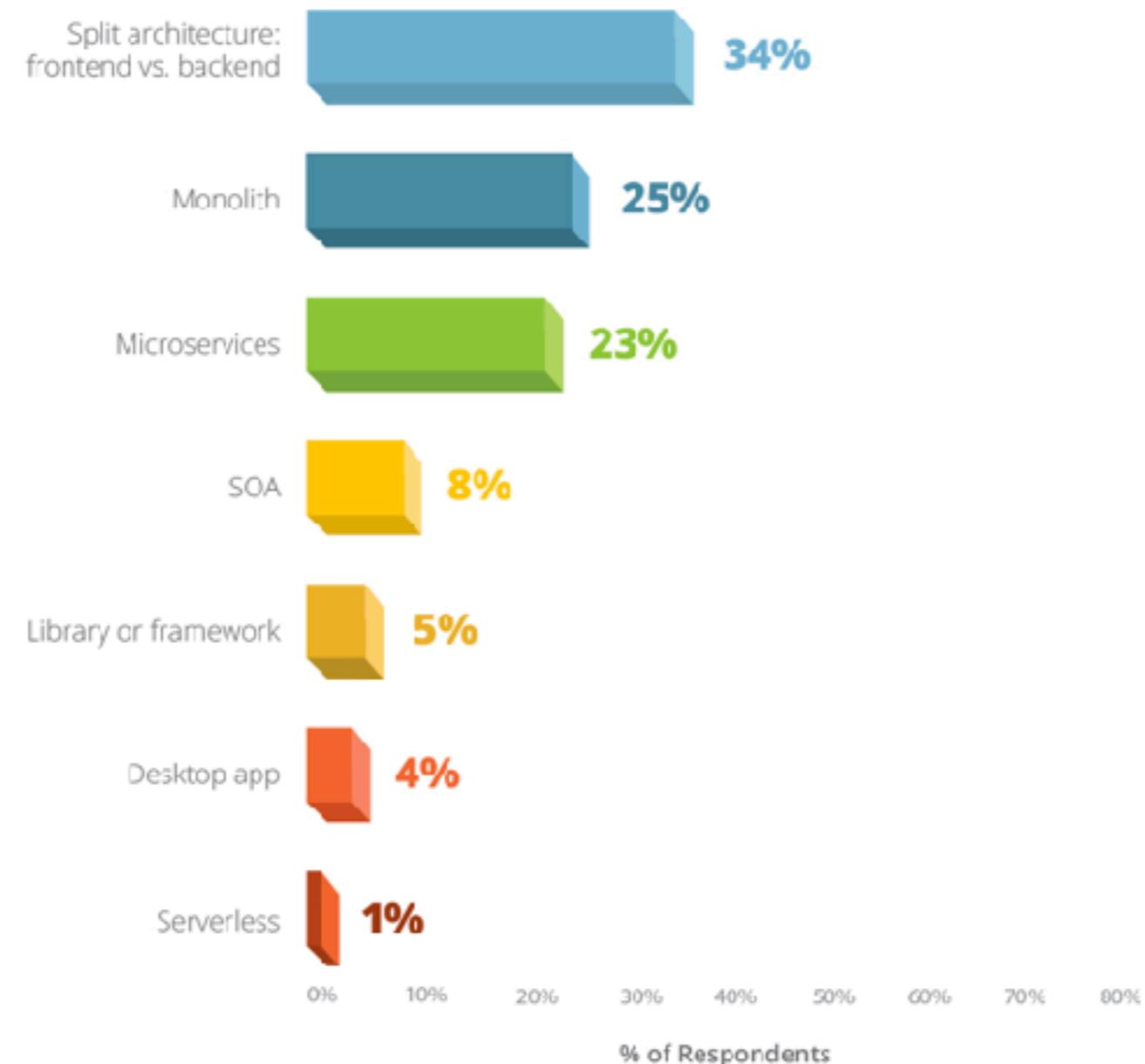
Java frameworks

The **Spring vs. Java EE debate** is going nowhere

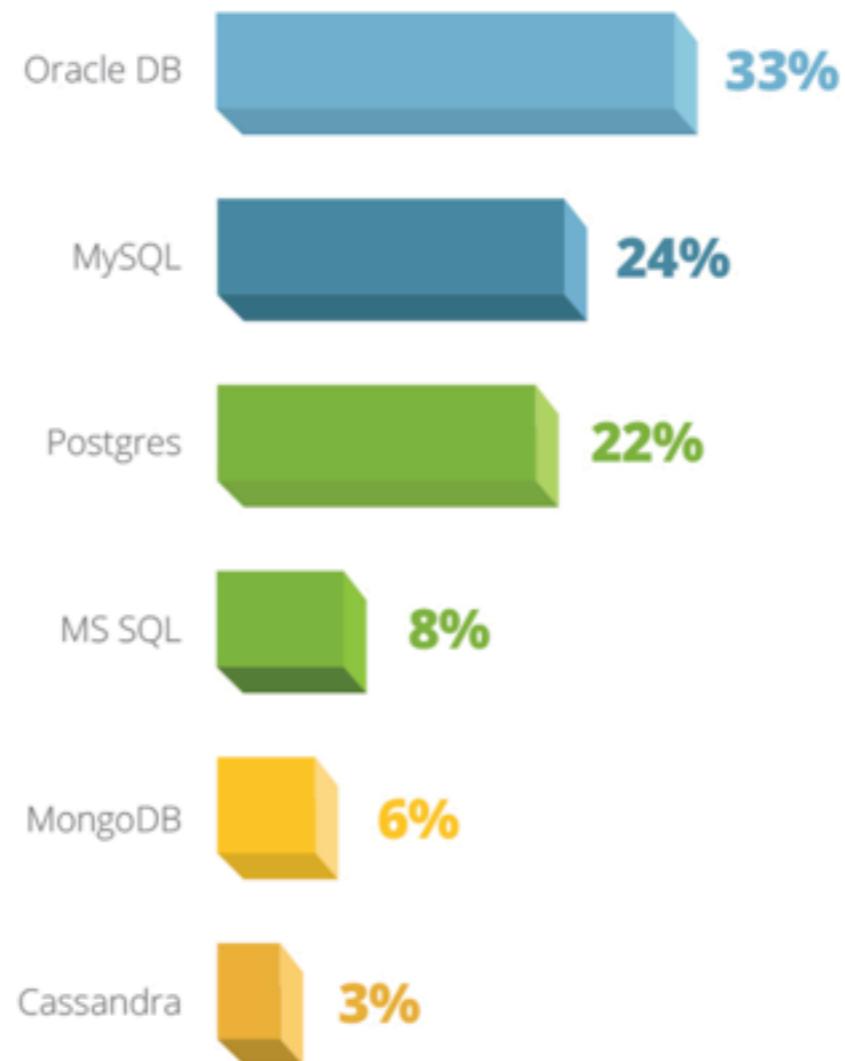


Architecture ?

Architecture choice is largely split, except for split architecture



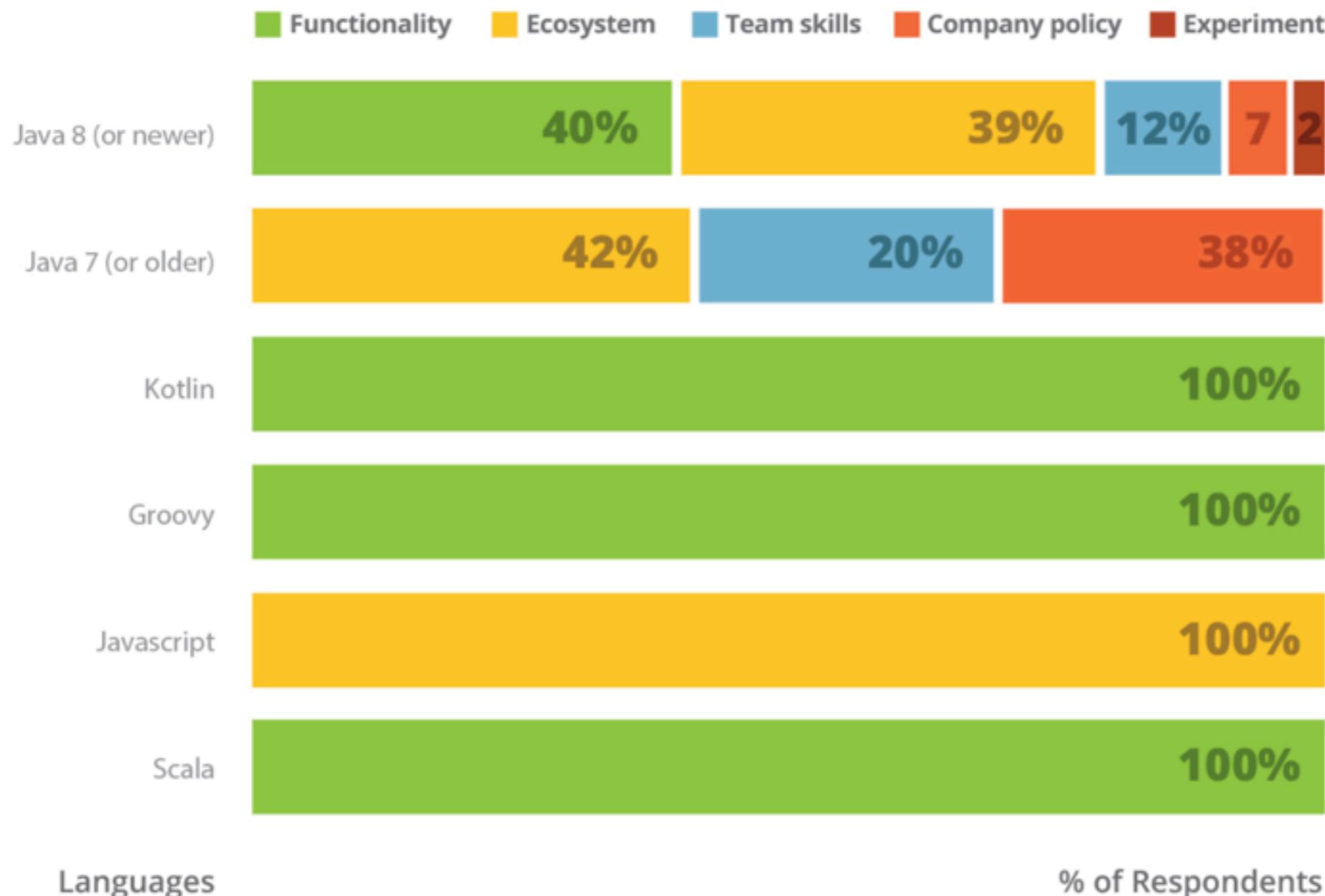
Database



Other languages



Reasons to use



Are you too busy to improve?



Thank you Q/A

