Microservices with Spring Boot & Spring Cloud

August 22 to 26, 2022

We have a ‘packed’ Agenda

- Spring Boot, Spring MVC & Spring Data
- Building a simple monolith
- Introducing REST APIs
- Break the monolith
- Communication between services using OpenFeign
- Introducing Microservices & Spring Cloud
- Exploring Spring Cloud - Cloud Capabilities
  - Configurations - Spring Cloud Config Server
  - Resilience - Resilience4j
  - Discovery - Eureka Service Discovery
  - Gateway - Spring Cloud API Gateway
  - Tracing - Spring Cloud Zipkin & Sleuth

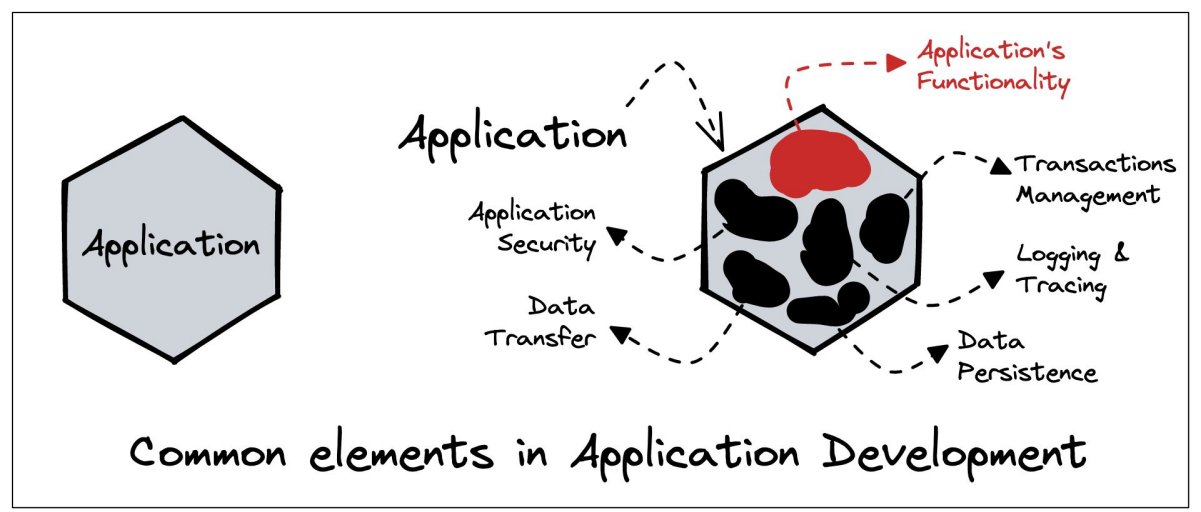
Subbu M

- 12 years and counting
  - Enterprise product design, architecture, development and deployment patterns and technologies
  - Cloud-native and cloud migration product design
  - Kubernetes
-

Spring Boot, Spring MVC & Spring Data

Application Development

- Every application is different, but every application is also same



What is Spring?

- an application framework that provides a foundational structure for developing an application
- makes application development effortless
- an ecosystem of application frameworks
  - Data, messaging, security, APIs, communication, testing, cloud, etc.
  - https://spring.io/projects
- The ecosystem revolves around Spring Core - that provides the Spring Application Context - the magical stage where the application play unwinds!

Inversion of Control (IoC)

- So, what is IoC?
- Usually the application controls the execution of the code through dependencies (instances, method calls)
- IoC means the framework control the application and its dependencies (dependency injection)

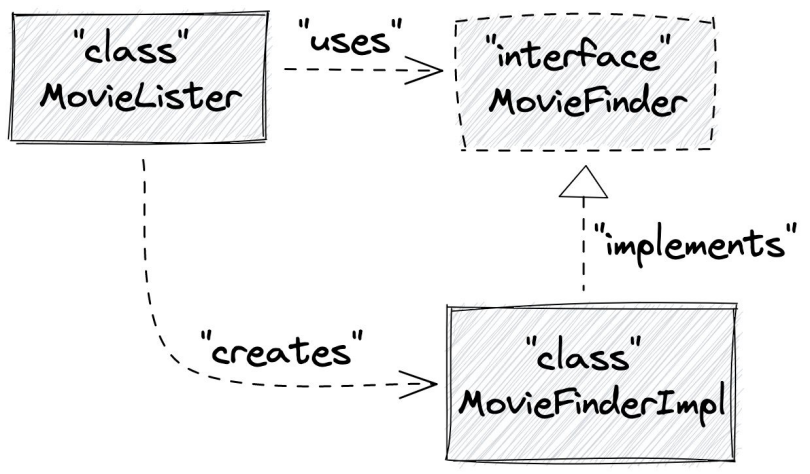
Let us explore the true meaning of IoC, as many find it confusing

- What control are we inverting?

What control are we inverting?

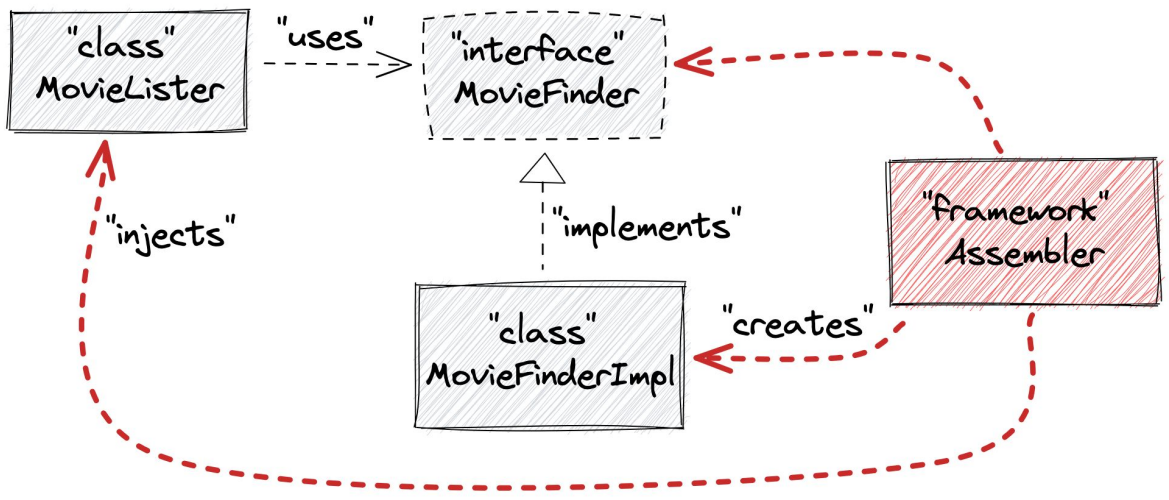
- Martin Fowler's article: https://martinfowler.com/articles/injection.html

- The MovieLister class is dependent on both the MovieFinder interface and upon the implementation.
- Desirable:
  - The implementation is not linked at compile time, but plugged in at some later time



The basic idea of Dependency Injection

- a separate object, an assembler, populates a field in the lister class with an appropriate implementation for the finder interface, resulting in a dependency diagram



Spring Application Context

- Spring Application Context
  - The dependency injection assembler
  - a memory location in which we add the object instances that we want Spring to manage
  - almost everything in a Spring application happens through the context

Lab

- Placing an object in the Spring Application Context
- Placing multiple objects of the same type in the context

Lab

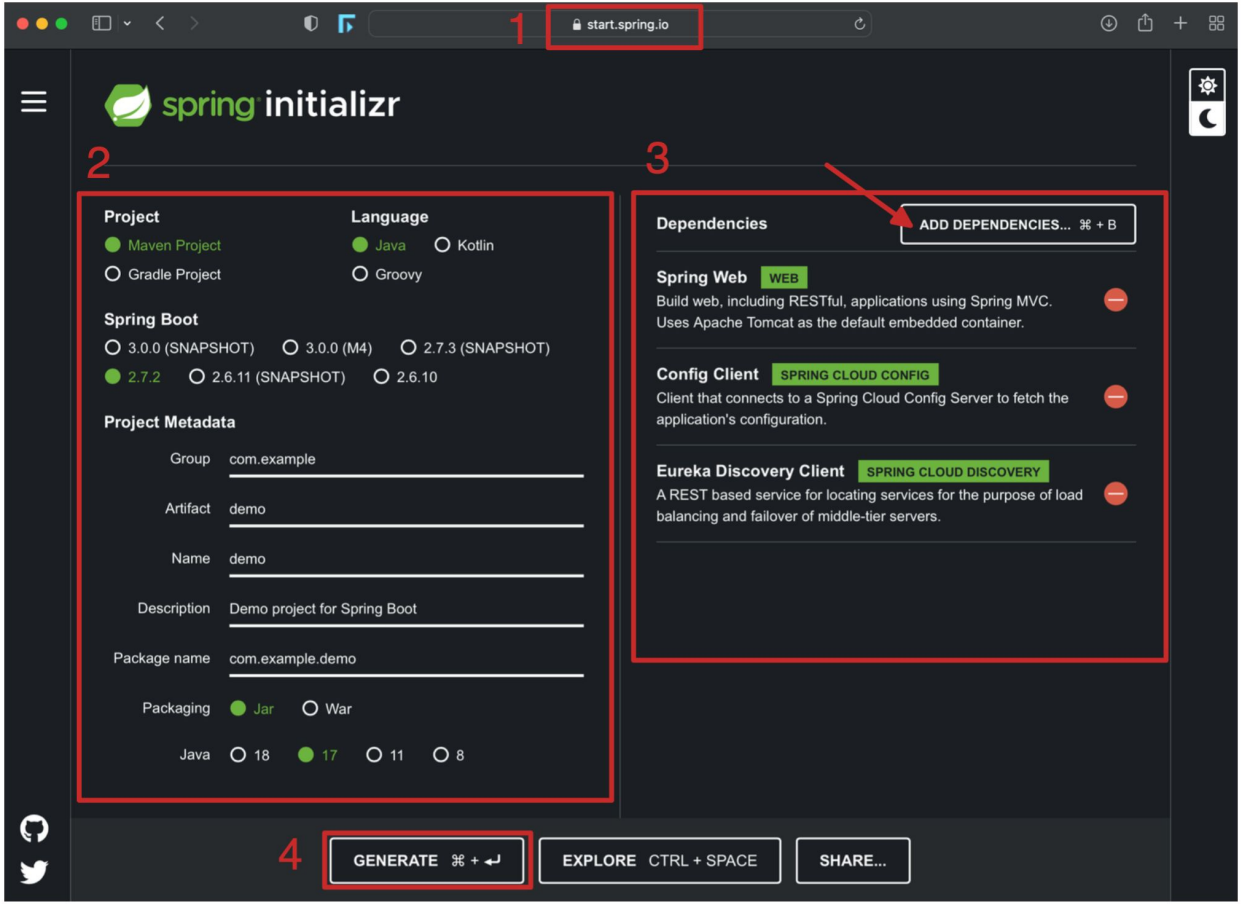
- Wiring Beans - @Component
- Wiring between two @Components
- Wiring for abstractions
- @Service
- @Repository
- Bean Scopes - Singleton & Prototype

Spring Boot Introduction

- a tool for implementing modern Spring applications
- Why Spring Boot?
  - In your microservices journey, you will be creating & update microservices applications more often
  - Configurations are a huge part of developing modern applications like microservices
  - Spring Boot lets you concentrate on developing the business functionalities, by helping eliminate the code related to dealing with configurations

Spring Boot - notable features

- Project Creation:
  - simplified and faster project creation
- Dependency starters:
  - dependency starters group dependencies for specific areas of application development, like persistence or messaging or stream processing
- Auto-configuration:
  - based on the dependencies added to the project, Spring Boot defines default configurations.



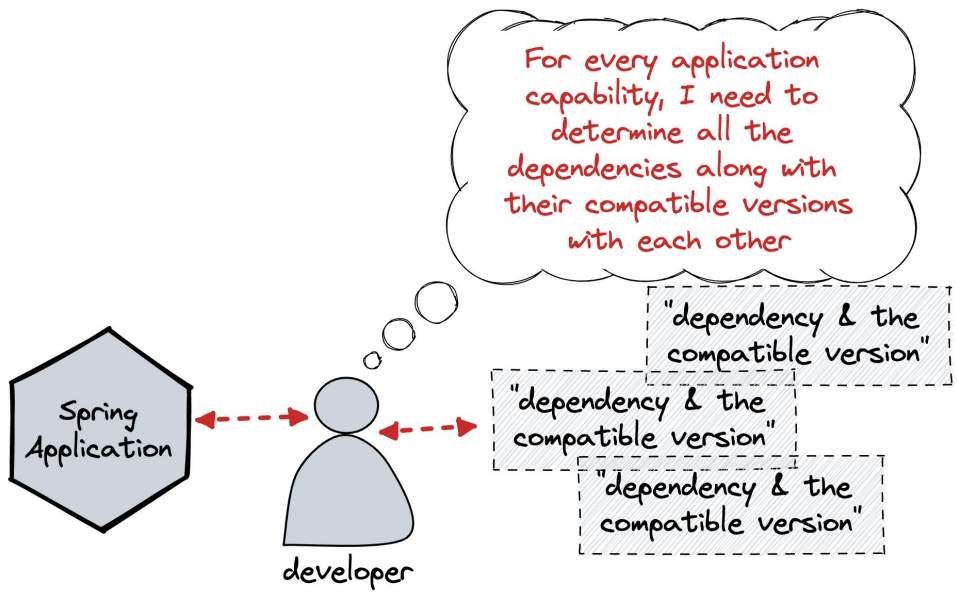
Spring Boot - How To (A 5-step process)

Lab

- Creating the first simple Spring Boot application
  - How it looks!
  - 5 things to note!

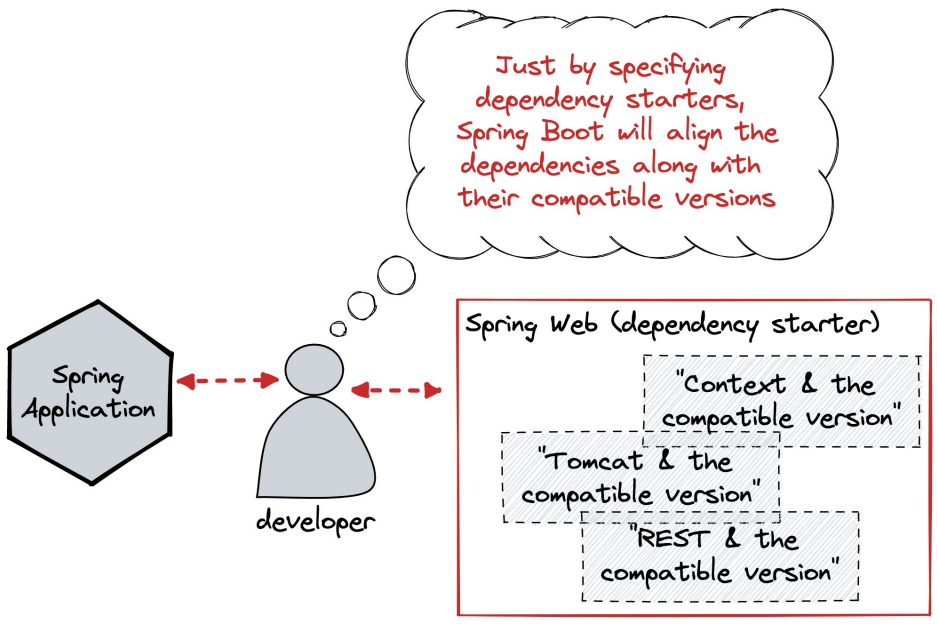
Dependency Starters

- Without Dependency Starters - the normal way of application building



Dependency Starters

- A dependency starter is a group of compatible dependencies that we add to the application for a specific purpose or specific areas of application development



Convention over configuration

Spring Boot chose to run the application in an embedded tomcat on port "8080"

```
Tomcat initialized with port(s): 8080 (http)
Starting service [Tomcat]
Starting Servlet engine: [Apache Tomcat/9.0.65]
Initializing Spring embedded WebApplicationContext
Root WebApplicationContext: initialization completed in 1229 ms
Tomcat started on port(s): 8080 (http) with context path ''
Started FirstSimpleBootApplication in 2.614 seconds (JVM running for 3.106)
```

server.port=8181

```
Tomcat initialized with port(s): 8181 (http)
Starting service [Tomcat]
Starting Servlet engine: [Apache Tomcat/9.0.65]
Initializing Spring embedded WebApplicationContext
Root WebApplicationContext: initialization completed in 1044 ms
Tomcat started on port(s): 8181 (http) with context path ''
Started FirstSimpleBootApplication in 2.007 seconds (JVM running for 2.448)
```

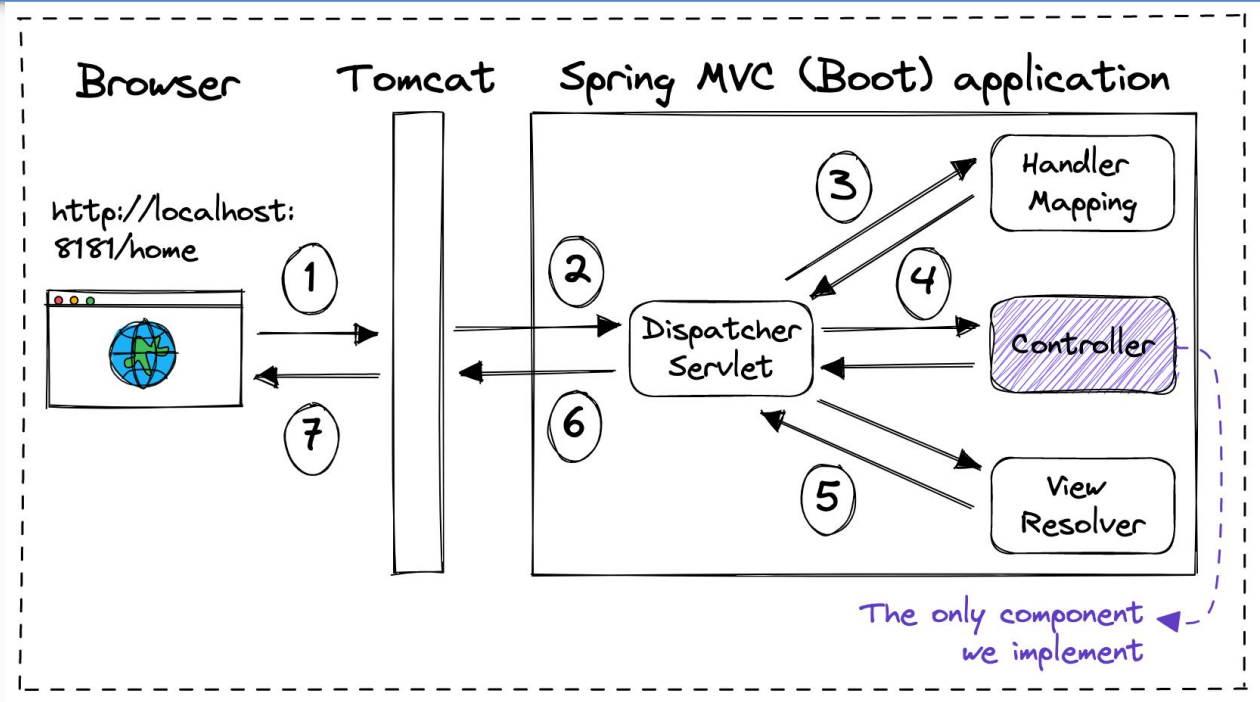
Spring Boot & Spring MVC

- The “Spring Web” dependency starter brings in all the components to build a Spring web application
- Model View Controller - A proven pattern for web applications
  - Model - conduit between controllers and data store
  - Controller - logic for handling input or requests to specific pages
  - View - handles data passed via the controller, then presents the data onscreen
- With Spring Boot, all happens in 2 steps: as simple as that

Lab

- Creating a static web application

Web Application - How things work



Spring Boot - Dynamic Web Application

- Dynamic web apps need dynamic web pages
- There are many proven ways in Java to build dynamic web pages
- Template engines are less intrusive, and you will be writing HTML + something to that add dynamism to the web page
- Thymeleaf is the preferred template engine by Spring Boot - Spring MVC

Lab

- Creating a dynamic web application

Spring Boot - Sending Data through request

- Use the following ways to send data through the HTTP request
  - request parameter
  - path variable
  - request header
  - request body
- We will try the first two options:
  - request parameter
  - path variable

Lab

- Getting the colour as request parameter
- Getting the gift as path variable

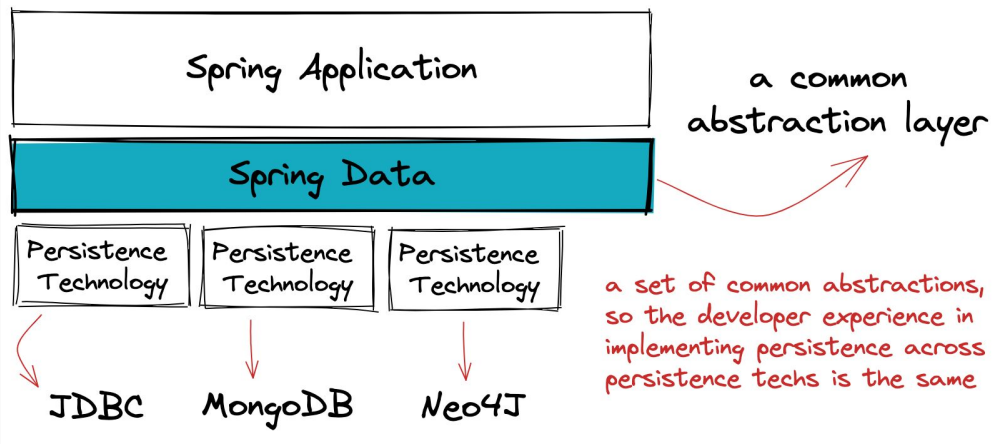
Building a monolith

Lab

- A simple library - monolith application with in-memory storage

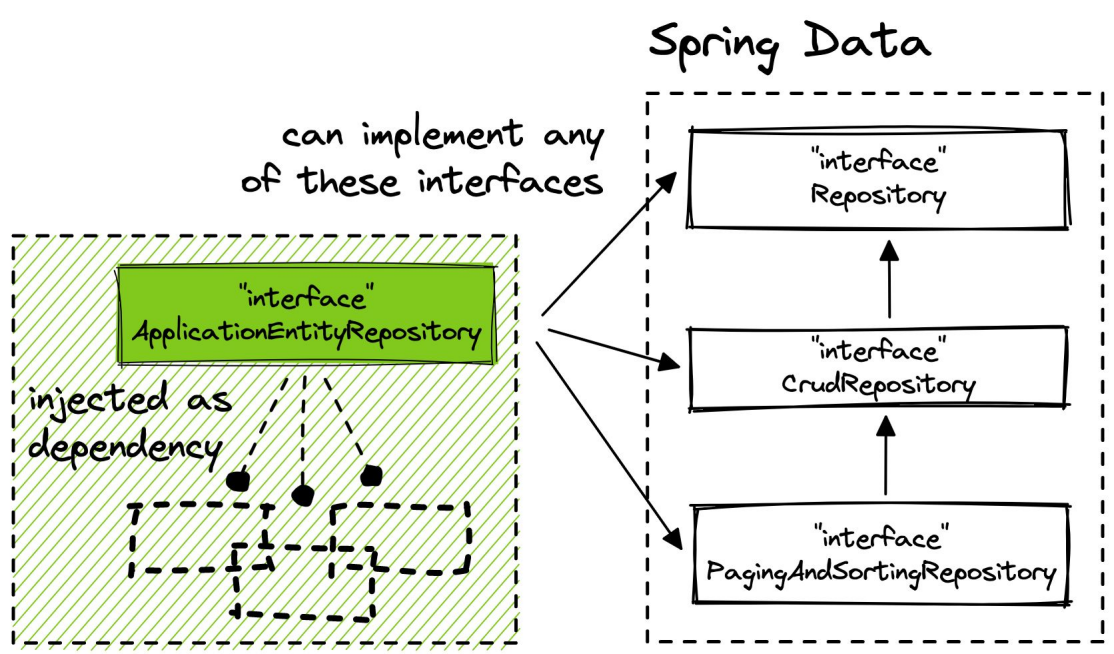
Spring Data - a run through

- provides common set of abstractions for various persistence technologies, so the approach to implement persistence across persistence technologies is similar



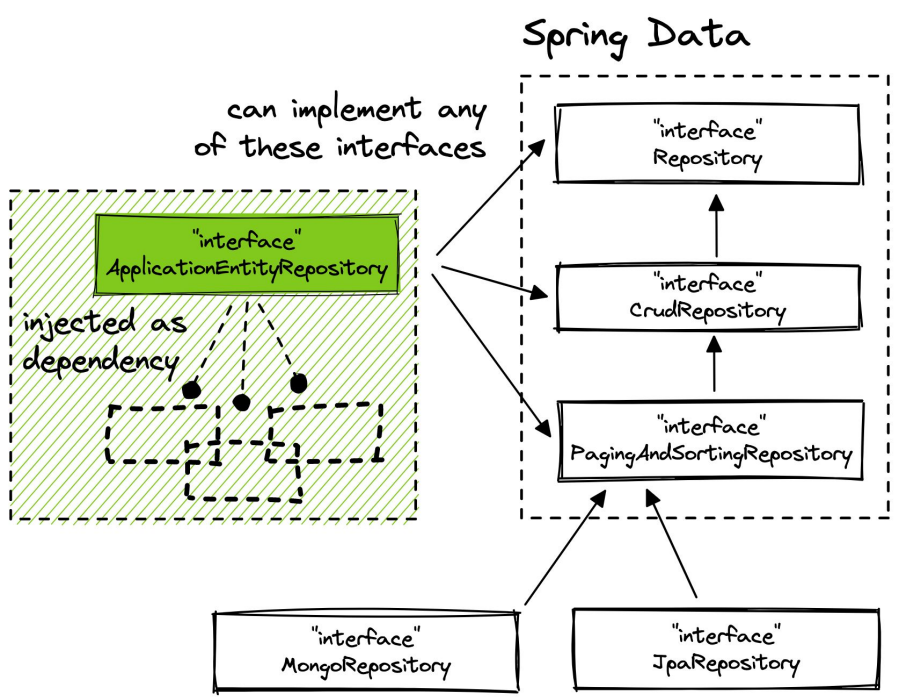
Spring Data - how does it work?

- one dependency starter for each persistence technology
- few common abstractions that can be extended for persisting application data



Spring Data - new age persistence?

- Apart from the common capabilities, Spring Data modules provide specific contracts for specific technology capabilities
  - https://spring.io/projects/spring-data



Spring Data - how to!

- add the dependency to represent the underlying persistence technology
  - For JDBC, add Spring Data JDBC
  - For JPA, add Spring Data JPA
  - For MongoDB, add Spring Data MongoDB
- extend the interface to represent the capabilities needed
  - CrudRepository
  - PagingAndSortingRepository
  - JpaRepository
  - MongoRepository

Lab

- A simple library - monolith application, persisting in H2

REST APIs &
Building REST services

REST using Spring Boot

```java
@Controller
public class LibraryAPIController {
    @RequestMapping(path = "/library",
            method = RequestMethod.GET)
    @ResponseBody
    public String sayHello() {
        return "Welcome to our Library";
    }
}
```

```java
@RestController
public class LibraryAPIController {
    @GetMapping("/library")
    public String sayHello() {
        return "Welcome to our Library";
    }
}
```

```java
@Controller
public class LibraryAPIController {
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```

A bit more REST using Spring Boot

```
@RestController
public class LibraryAPIController {
    @GetMapping("/library")
    public Book sayHello() {
        return new Book("Wings of Fire",
                "APJ Abdul Kalam", 400,
                LocalDate.now());
    }
}
```

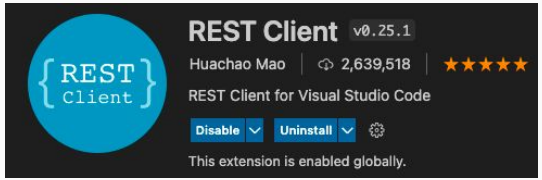
- We can return objects
- Spring Boot defaults the object representation to JSON (uses Jackson)

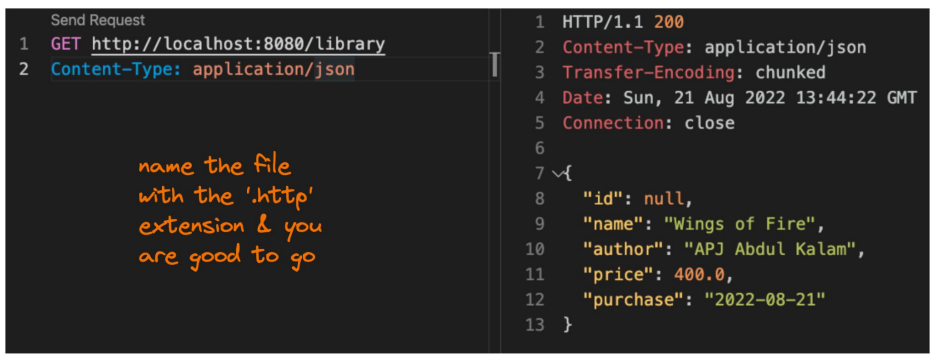
As you can see, we need a better tool to REST!

Better tool to REST!

- There are many tools (open-source) available to do REST better
  - PostMan is the most famous
- In fact, we can write our own tool to play REST

We will use Visual Source Code with REST Client plugin





A bit more REST using Spring Boot

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- We can return objects
- Spring Boot defaults the object representation to JSON (uses Jackson)

As you can see, we need a better tool to REST!

Breaking the monolith

Communication between services using OpenFeign

Introducing Microservices & Spring Cloud

Configurations - Spring Cloud Config Server

Resilience - Resilience4j

Discovery - Eureka
Service Discovery

Gateway - Spring Cloud API Gateway

Tracing - Spring Cloud Zipkin & Sleuth

Materials

- Item 1
- Item 2
- Item 3
- Item 4
- Item 5

Homework

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