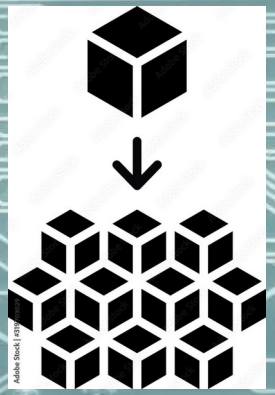
Spring/Backend Fundamentals

Full Stack Bootcamp (Day 4)

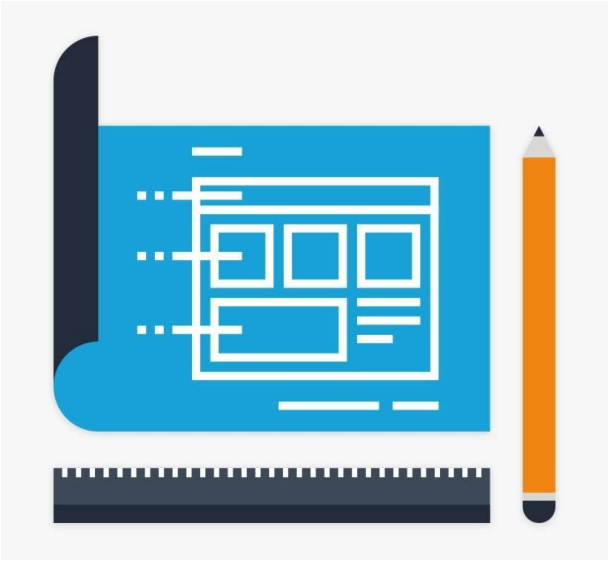


Agenda

- Day 1
  - ES6+
- Day 2
  - React Native
- Day 3
  - Angular
- Day 4
  - Springboot
  - SpringData
- Day 5
  - JSON
  - NoSQL
- Day 6
  - Relational
- Day 7
  - Junit
  - Mockito
- Day 8
  - Docker
- Day 9
  - Kubernetes
- Day 10
  - Images and tips

Welcome to the back-end nightmare.

- Architecture definitions
- Web services
- Type of architectures
  - Microservices based architecture
  - Event Driven Architecture
- What else to learn

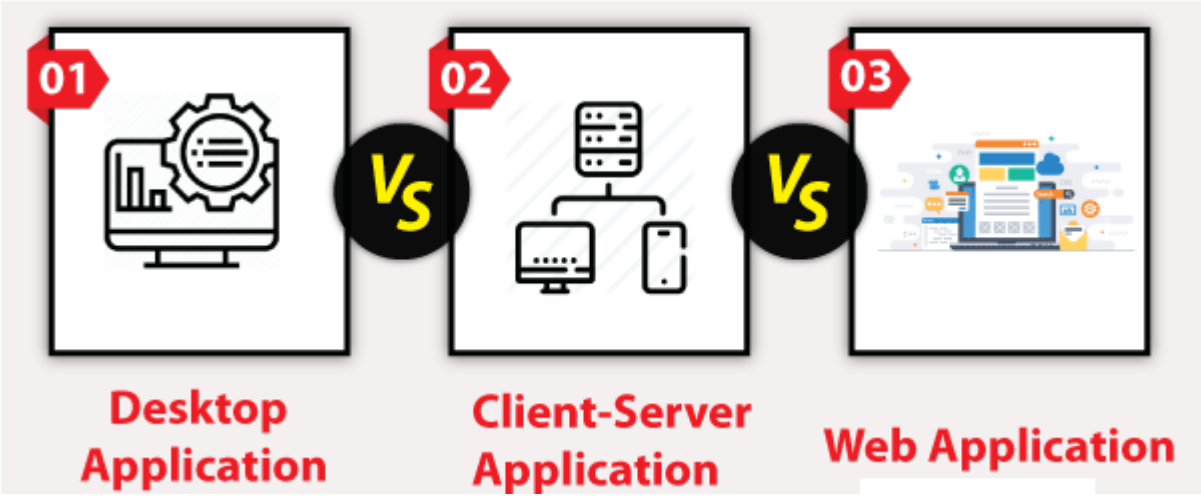


Architecture definitions

- Languages type:
  - Scripting
  - Procedural
  - OO
  - Functional
  - OO+Functional

Architecture concepts (2)

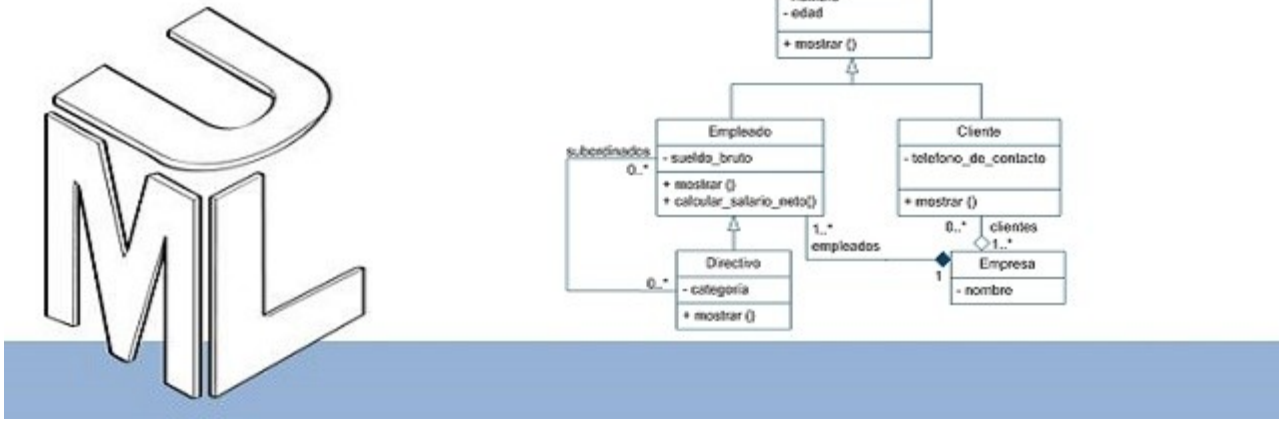
- Applications type
  - Stand alone
  - Client/Server
  - Web based



- Microservices based Architecture

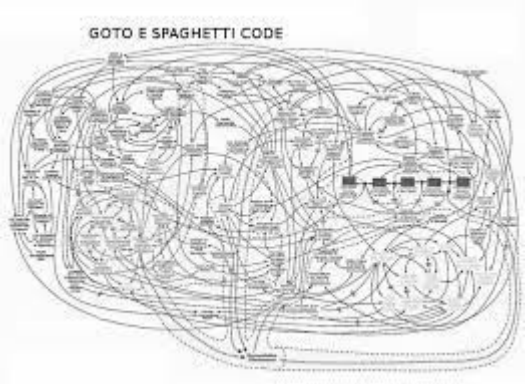
Architecture definitions

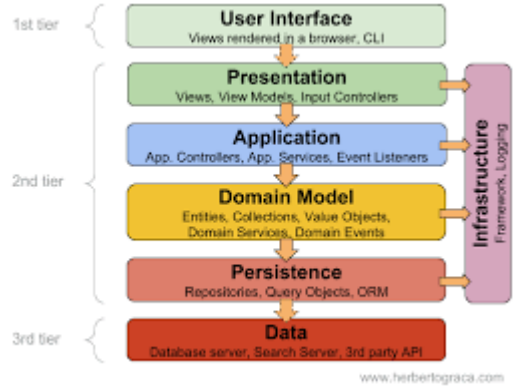
- Design Patterns
  - Monolithic DP
  - Microservices



Microservices based Architecture

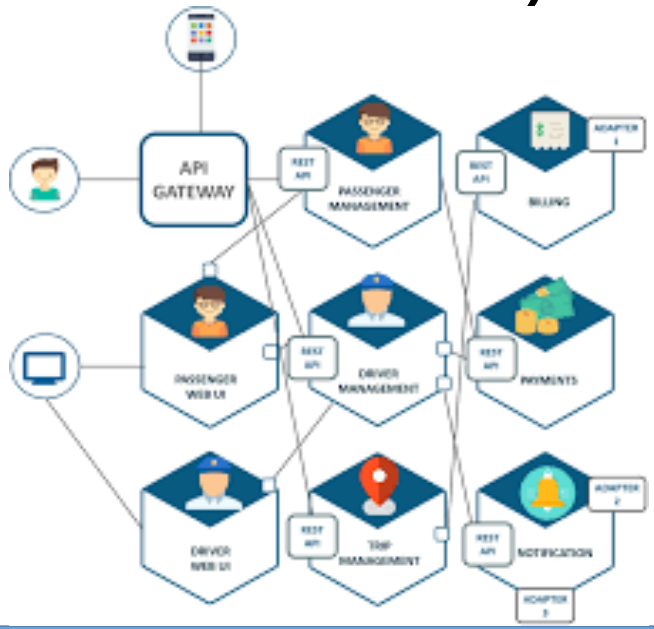
- The spaghetti monster
  - Responsibility delegation (OOP)
- Layered applications
- Monolithic based application
- Decoupling applications





Microservices advantages

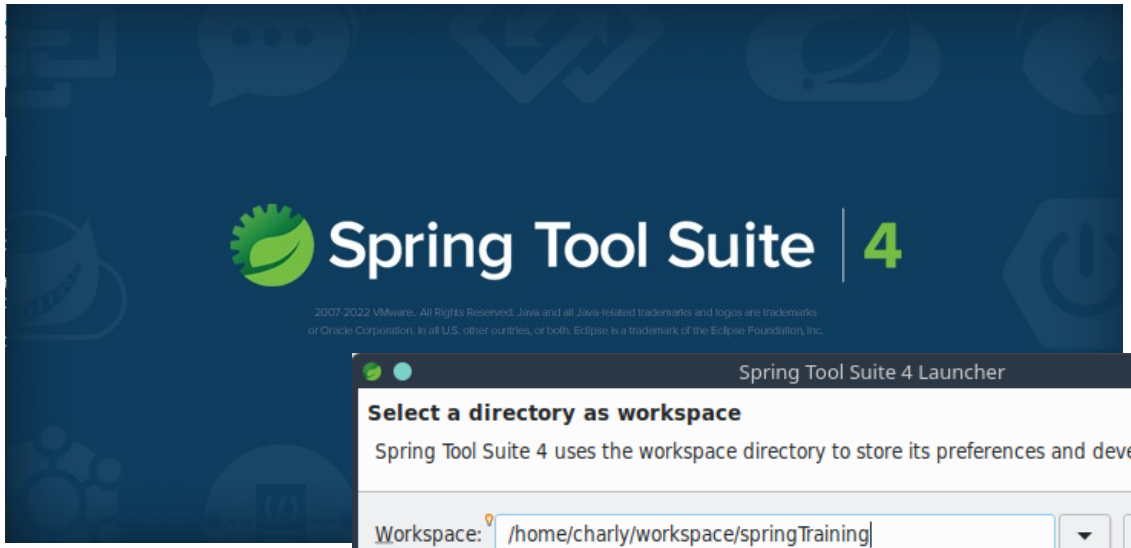
- Independence on processes
- Easier to maintain (when well documented)
- Security
- Flexible
- Integration with Agile



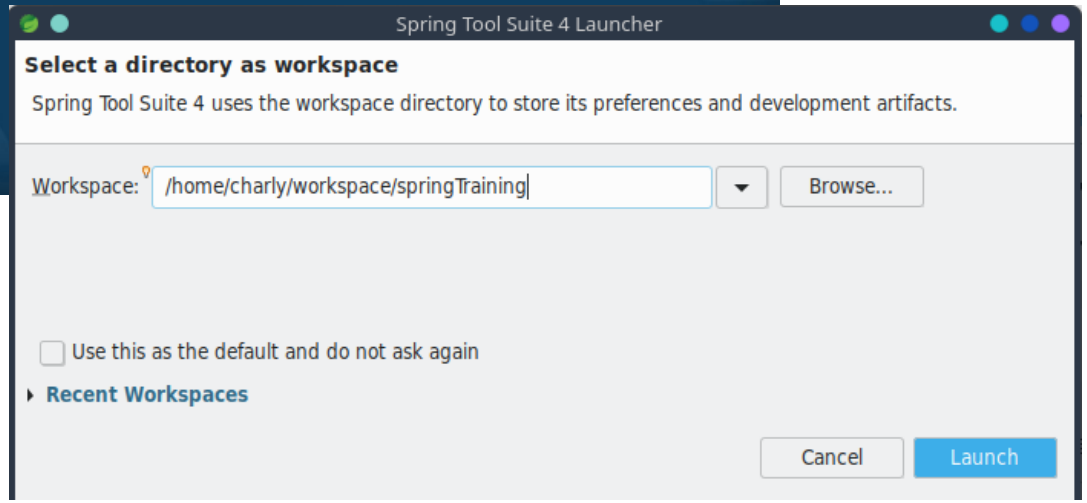
Eclipse IDE quick view

- Download and Installation
- “flavors” (MyEclipse, Eclipse, Spring Tools, Android Studio)
- Other Options (IntelliJ, Netbeans, VisualStudio Code)

Eclipse

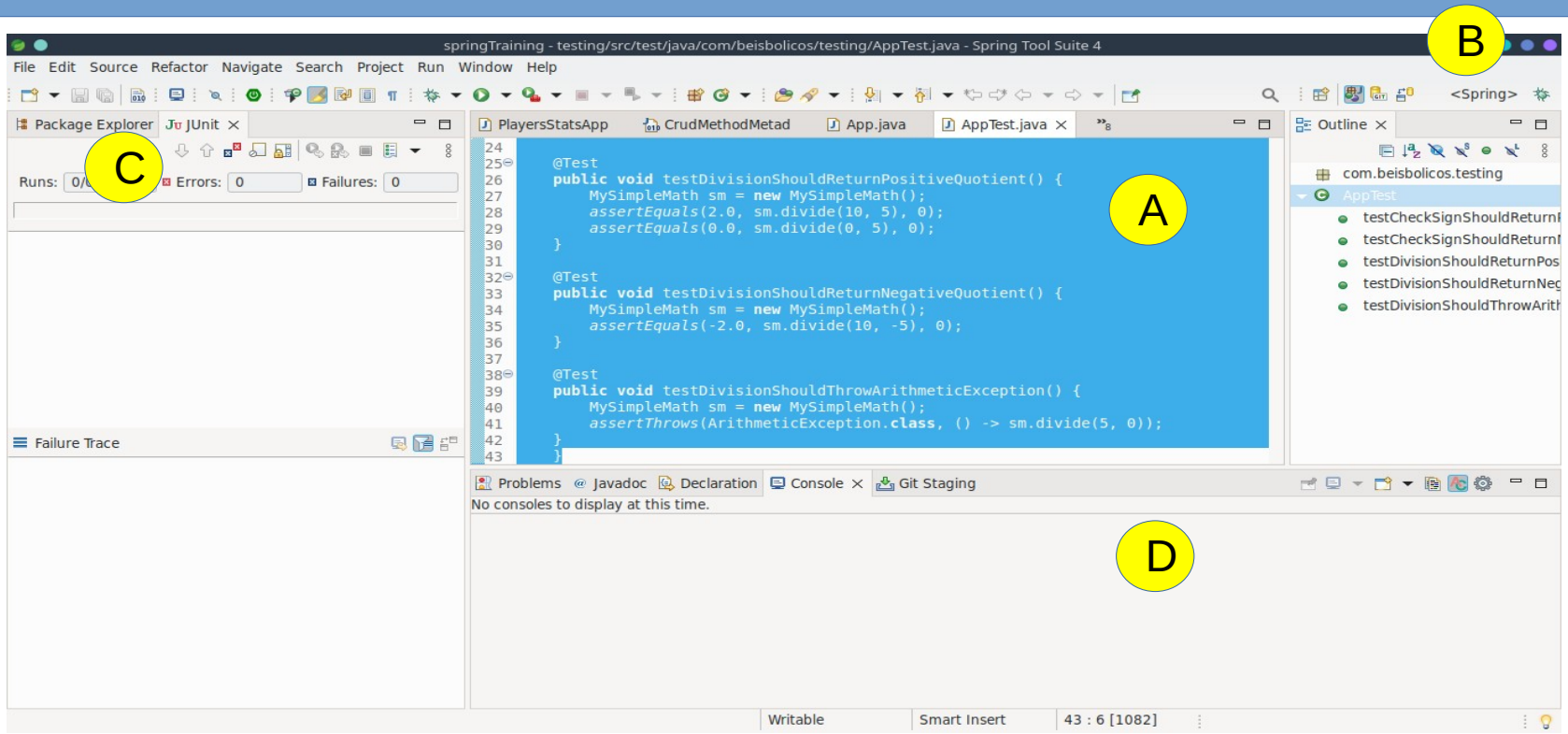


Welcome Screen



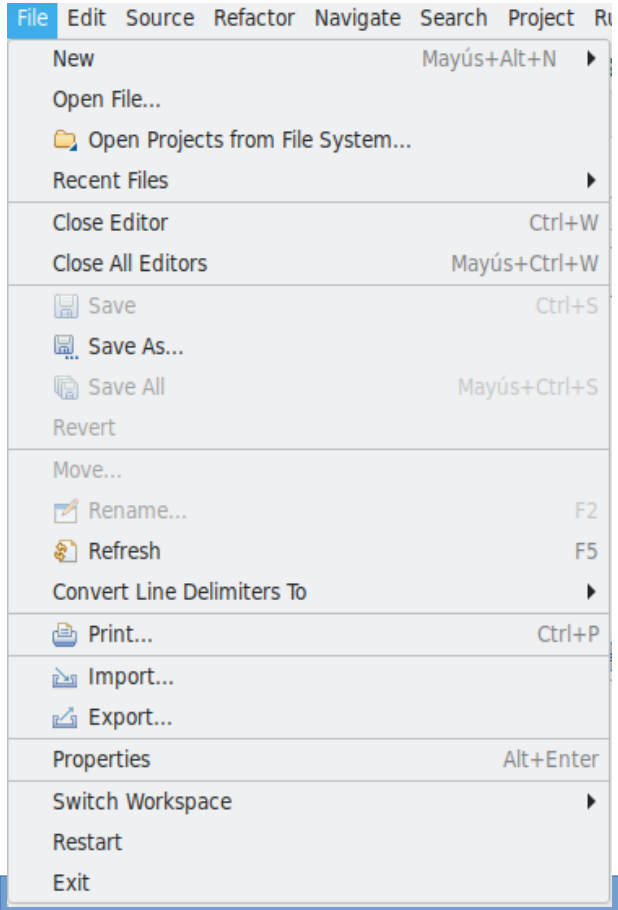
Workspace selection

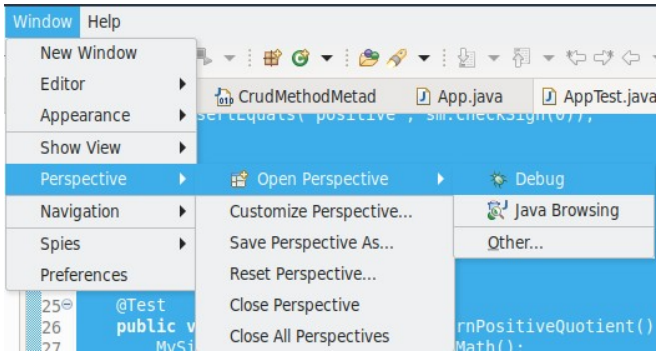
Eclipse

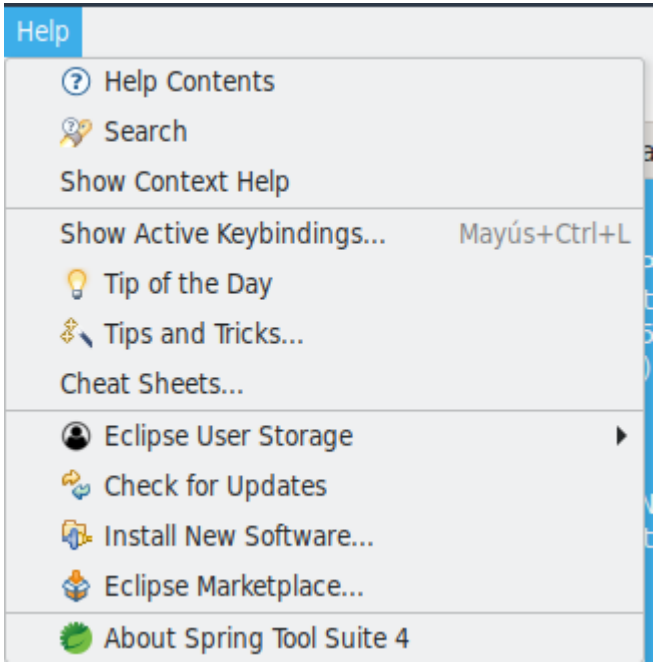


- A=Editor
- B=Perspective
- C=Project Navigator
- D=Console and debugging

Eclipse


File
Edit
Source
Refactor
Navigate
Search
Project
New Mayús+Alt+N
Open File...
Open Projects from File System...
Recent Files
Close Editor Ctrl+W
Close All Editors Mayús+Ctrl+W
Save Ctrl+S
Save As...
Save All Mayús+Ctrl+S
Revert
Move...
Rename... F2
Refresh F5
Convert Line Delimiters To
Print... Ctrl+P
Import...
Export...
Properties Alt+Enter
Switch Workspace
Restart
Exit

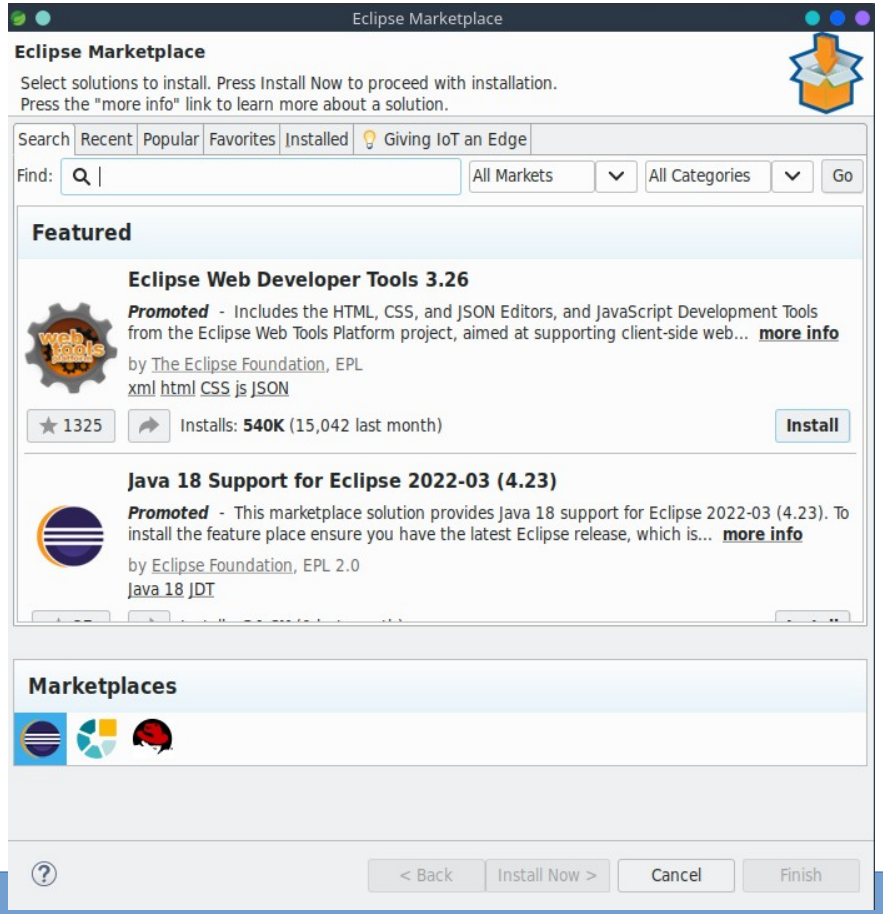

Window
Help
New Window
Editor
Appearance
Show View
Perspective
Navigation
Spies
Preferences
Open Perspective
Customize Perspective...
Save Perspective As...
Reset Perspective...
Close Perspective
Close All Perspectives
Debug
Java Browsing
Other...
CrudMethodMetad
App.java
AppTest.java


Help
Help Contents
Search
Show Context Help
Show Active Keybindings... Mayús+Ctrl+L
Tip of the Day
Tips and Tricks...
Cheat Sheets...
Eclipse User Storage
Check for Updates
Install New Software...
Eclipse Marketplace...
About Spring Tool Suite 4

Eclipse

- The toolbar provides shortcut buttons for the most common tasks such as run a program, create new classes or packages, find, debug it and so on.

Eclipse Marketplace



The place for addons:

- Themes
- Database explorers and designers (ERD)
- Other languages support (you usually install just one language per distribution)
- UML Tools

Maven and Gradle Introduction

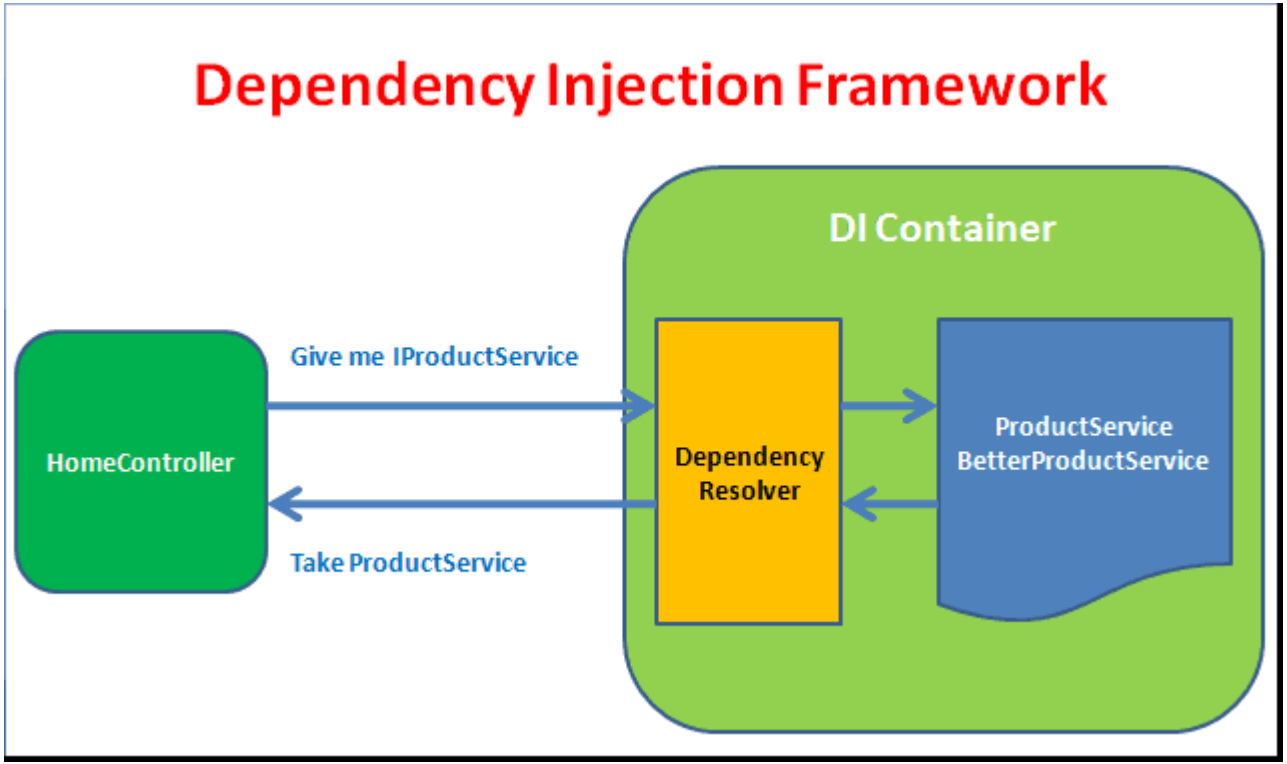
- Repositories
  - Global Maven repository
  - Mirrors
  - Corporate repositories
  - Local repositories

Git overview

- Whats a CVS?
  - CVS
  - SVN
- Branches
- Distributed Version System
  - git clone
  - git push
  - git add
  - git commit

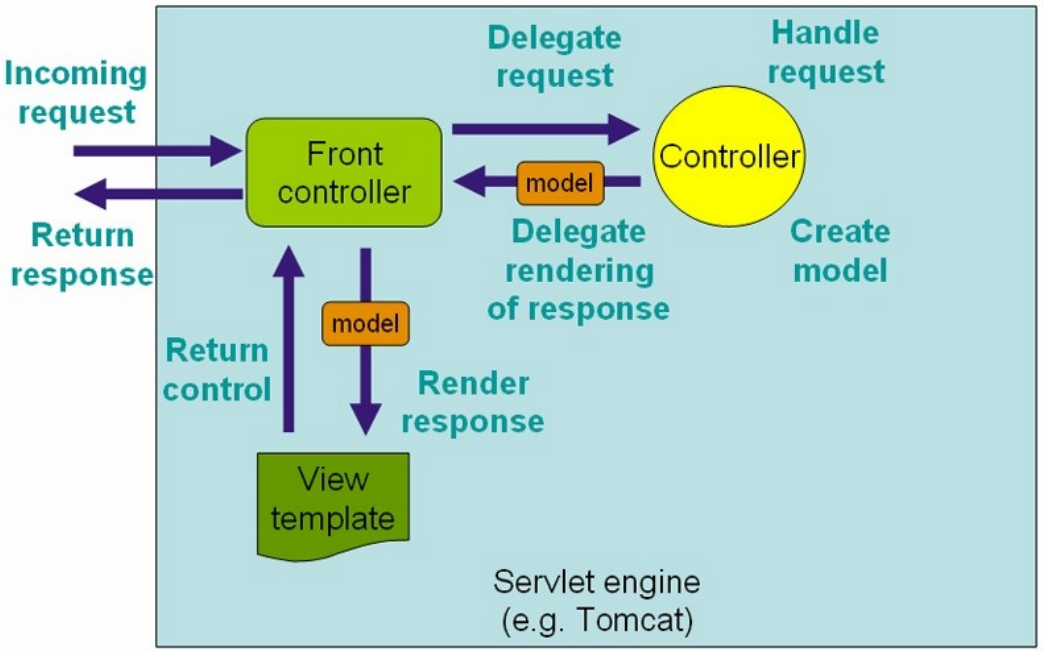
Dependency Injection

- Definition
- Java EE
- Spring
- Annotations



Spring MVC

- DispatcherServlet
- Configuration type
  - File based
  - Annotation based
- Beans
- Using Beans



Model View Controller

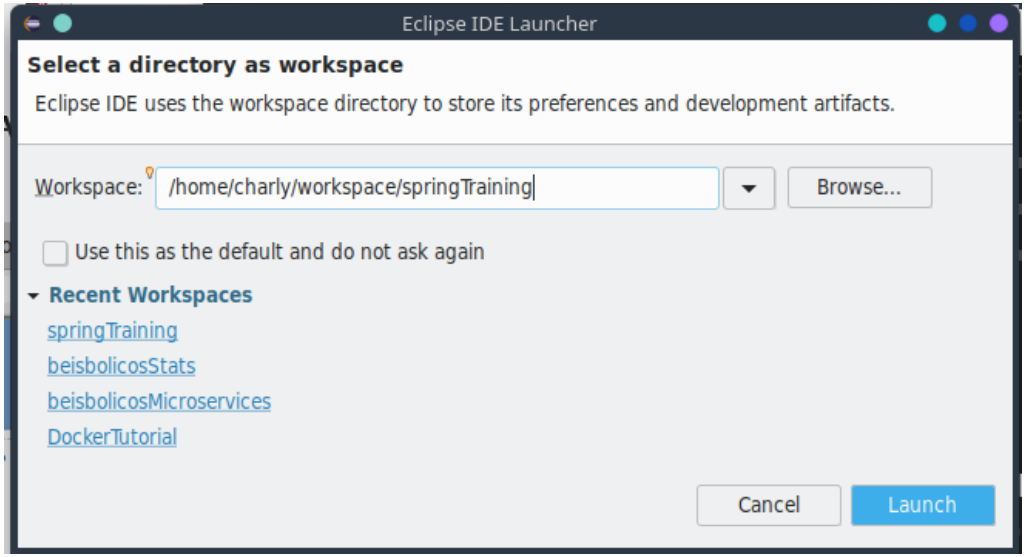
- Controllers are objects that will receive our requests and will process them
- Controllers are not used only for front end apps
- Controllers can redirect the servlet to a “View” that can be a web page or a webservice response, for this course we will be working with web services
- Views are the objects that “paint” the responses (usually a JSP or JSF) for this course our views are really the Angular or React front ends
- Model refers to the objects that represents a business object

Spring Boot (REST)

- ¿What's a web service?
- SOAP
- REST
- Http Verbs
  - @RestController
  - @GetMapping
  - @PostMapping
  - @DeleteMapping
  - @ResponseBody
  - @ResponseStatus
  - @ExceptionHandler

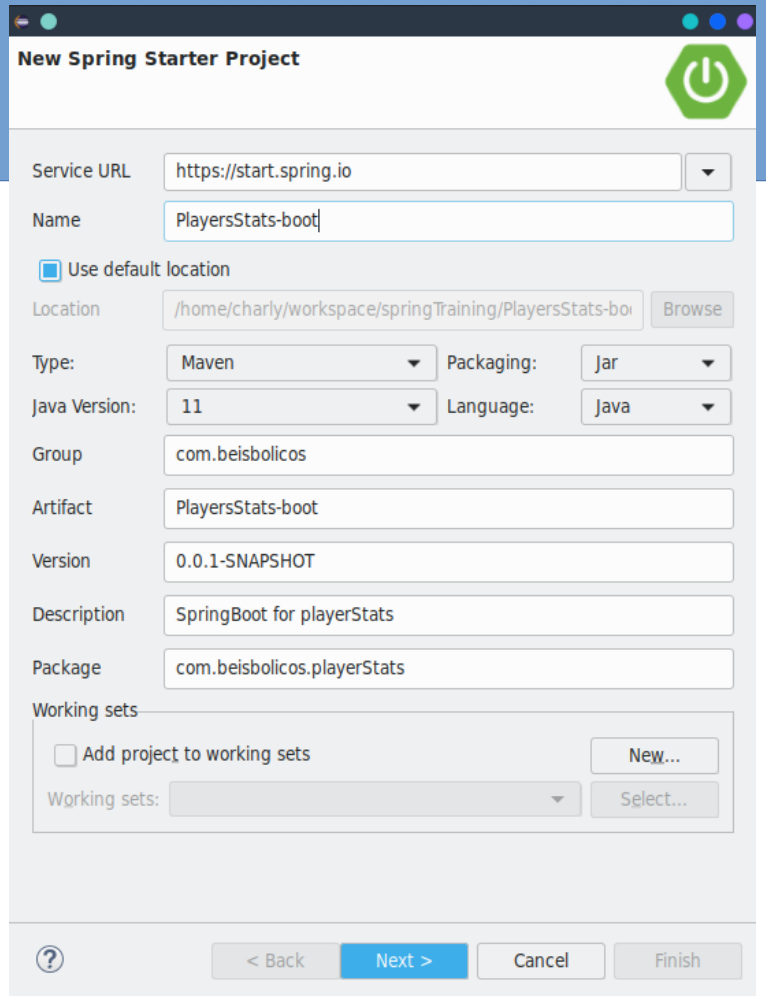
Hello World

- Understanding workplaces
- SpringTools

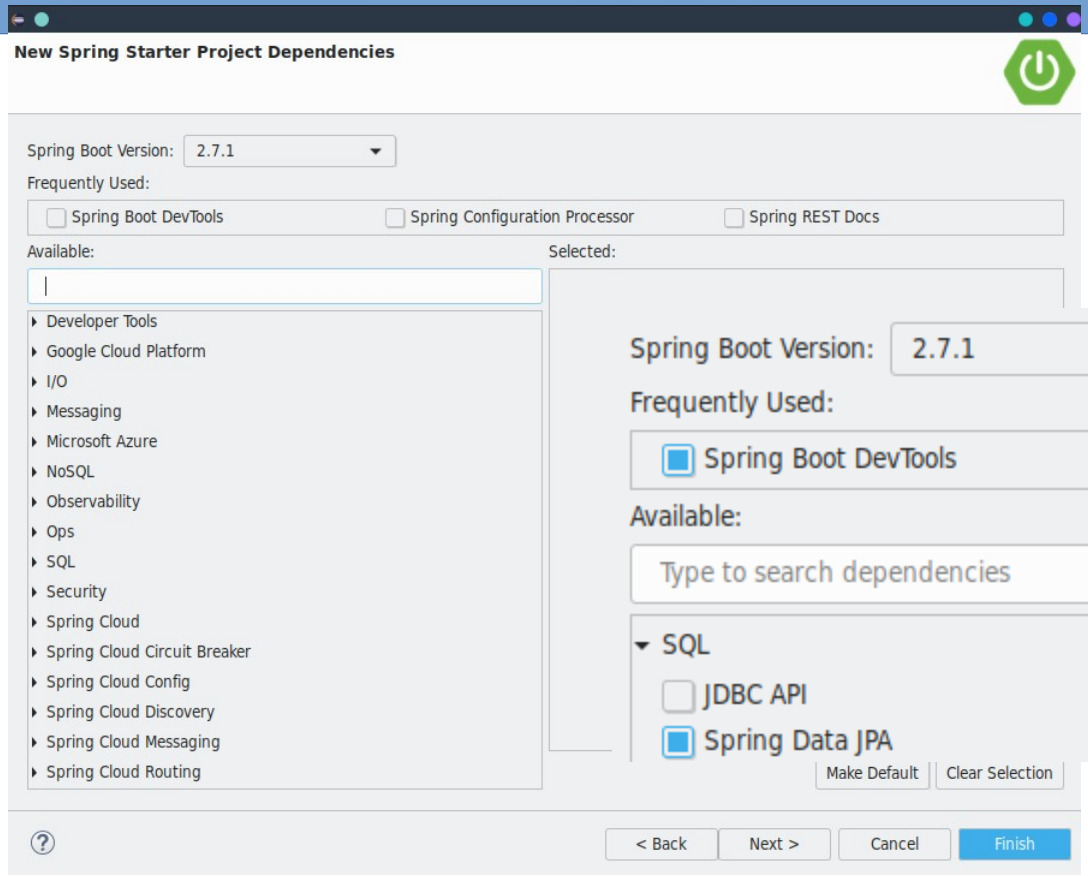


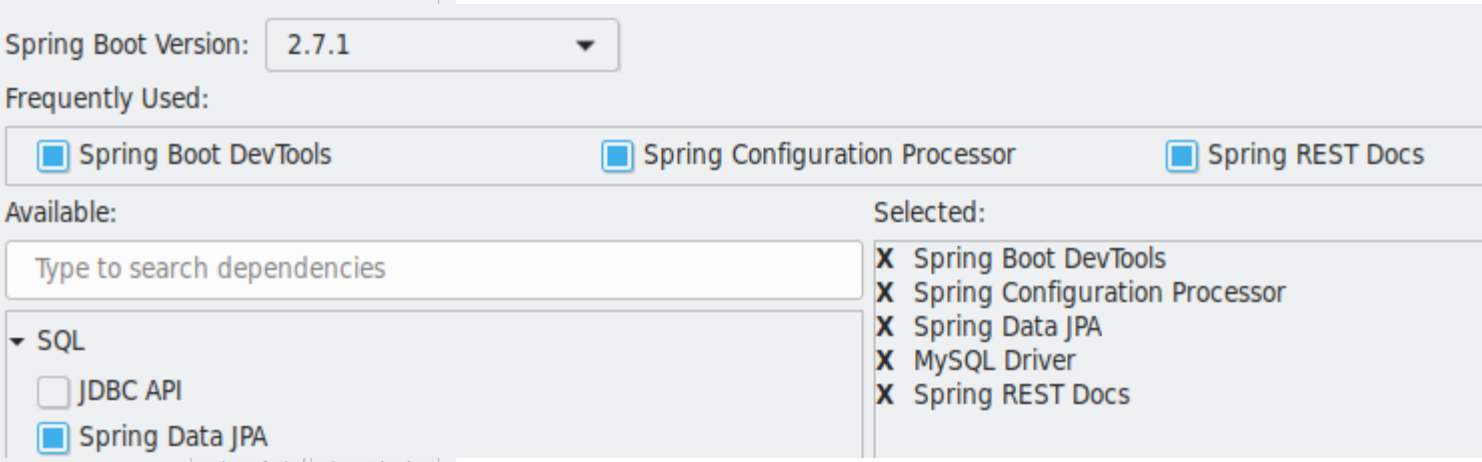
Create the project

- From the help Menu open the spring dashboard
- On the dashboard select “Create Spring Starter project”
- Select a name for your project



Create the project (2)





Overview

- Easy to create stand-alone, production-grade Spring based applications that you can “just run”.
  - It needs very little spring configuration.
- Create Java applications that can be started using java –jar or more traditional war deployments.
- Primary goals for the Spring Boot.
  - Provide a radically faster and widely accessible getting started experience for all Spring development.
  - Be opinionated out of the box, but get out of the way quickly as requirements start to diverge from the defaults.
  - Provide a range of non-functional features that are common to large classes of projects (e.g.embedded servers, security, metrics, health checks, externalized configuration).
  - Absolutely no code generation and no requirement for XML configuration.

Spring boot system requirements

- Even when it varies from version to version here are some recommendations to start with Spring boot
- Java 1.8 or above
- Tomcat 8 (or any servlet 3+ compatible app server)
- Maven/Gradle
- Java IDE (Eclipse, Jbuilder or Netbeans recommended)

Maven dependencies

```
<dependencies>
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-data-jpa</artifactId>
</dependency>
<dependency>
<groupId>org.springframework</groupId>
<artifactId>spring-web</artifactId>
</dependency>
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-devtools</artifactId>
<scope>runtime</scope>
<optional>true</optional>
</dependency>
<dependency>
<groupId>mysql</groupId>
<artifactId>mysql-connector-java</artifactId>
<scope>runtime</scope>
</dependency>
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-configuration-
processor</artifactId>
<optional>true</optional>
</dependency>
<dependency>
<groupId>org.springframework.boot</groupId>
<artifactId>spring-boot-starter-test</
artifactId>
<scope>test</scope>
</dependency>
<dependency>
<groupId>org.springframework.restdocs</groupId>
<artifactId>spring-restdocs-mockmvc</
artifactId>
<scope>test</scope>
</dependency>
</dependencies>
```

Hello World

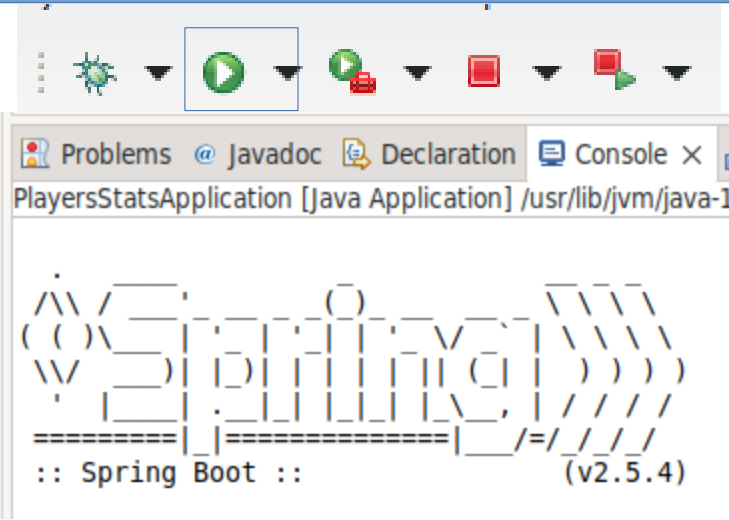
```
package com.beisbolicos.playerStats;

import org.springframework.boot.SpringApplication;
import org.springframework.boot.autoconfigure.SpringBootApplication;
import org.springframework.web.bind.annotation.RequestMapping;

@SpringBootApplication
public class PlayersStatsBootApplication {

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

	@RequestMapping("/")
	public String helloWorld() {
		return "Hello World";
	}
}
```

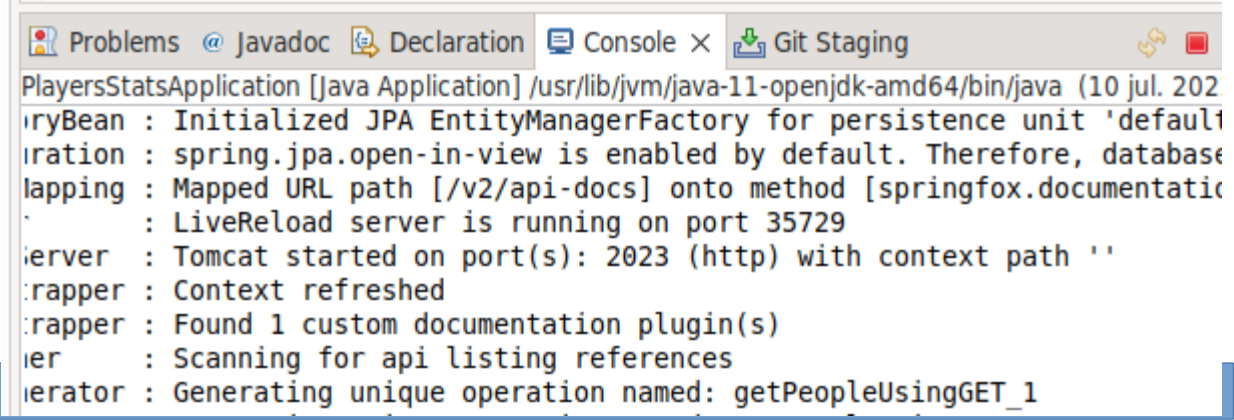
Exercise 1

- Install and set Eclipse IDE Spring tools

Run your app

- Click on the run button on the toolbar and look the springboot message
- Look in the console for the URL and open it





Configuring the project

- @Configuration annotation helps to create the configuration without XML files
- Application properties files is to set simple configuration variables needed.

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:context="htt
p://www.springframework.org/schema/context"
    xmlns:aop="http://www.springframework.org/schema/aop"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans-3.0.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context-3.0.xsd
    http://www.springframework.org/schema/aop
    http://www.springframework.org/schema/aop/spring-aop-3.0.xsd
    ">

    <bean id="country" class="org.arpit.java2blog.model.Country">
        <constructor-arg index="0" value="India"></constructor-arg>
        <constructor-arg index="1" value="20000"></constructor-arg>
```

Our back end app

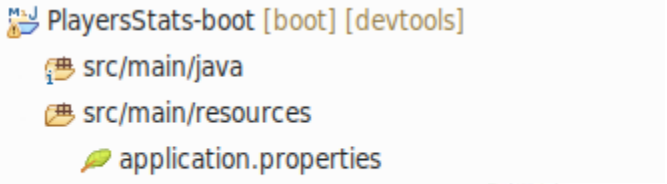
- We’ll be working with MySQL (please install it before proceeding). If you are not an MySQL expert a good idea is to install MySQL workbench as well
- The configuration class will provide the DB Connection parameters and will linked to the Spring injected classes.
- Our application will provide a REST API for the “Baseball Data Bank”, we will be providing just the “player” table for the example.

Exercise 2 and 3

Seting up our project database

Be aware that for the next exercise you need to understand all the rest of the course, you can create with the instructor the pieces while explaining but need all the pieces together to make it work.

Application.properties




```
1
2  server.port=2023
3
4  spring.datasource.url= jdbc:mysql://localhost:3306/baseballdb
5  spring.datasource.username=root
6  spring.datasource.password=Pqsfypqm1@
7
8  #spring.jpa.hibernate.ddl-auto=create-drop
9
10 spring.datasource.driver-class-name=com.mysql.cj.jdbc.Driver
11 #spring.datasource.hikari.connection-timeout=60000
12 spring.jpa.database=mysql
13
14 spring.jpa.properties.hibernate.dialect = org.hibernate.dialect.MySQL5Dialect
15 spring.jackson.serialization.FAIL_ON_EMPTY_BEANS=false
```

Spring Data JPA (Hibernate)

- JPA it’s a relational database access framework that has several implementations
- JPA translates the databases to Java Objects
- JPA implementations:
  - Hibernate
  - Eclipse Link
  - Apache JPA

EntityManager

- EntityManager is a component that spring will configure atuomatically and has all the resources to connect the entities to the DB, that is made with the DataStore configuration

```java
package com.beisbolicos.playerStats;

import javax.sql.DataSource;

@Configuration
@EnableJpaRepositories(basePackages = { "com.beisbolicos.playerStats.repo" })
@ComponentScan(value = "com.beisbolicos.playerStats.*")
@EntityScan(basePackages = { "com.beisbolicos.playerStats.entity" })
public class DataStoreSetup {

    @Value("${spring.datasource.url}")
    String databaseUrl;

    @Value("${spring.datasource.username}")
    String databaseUser;

    @Value("${spring.datasource.password}")
    String databasePassword;

    @Bean
    public DataSource dataSource() {

        DriverManagerDataSource dataSource = new DriverManagerDataSource();
        dataSource.setUrl(databaseUrl);
        dataSource.setUsername(databaseUser);
        dataSource.setPassword(databasePassword);
        return dataSource;
    }

}
```

The Entities (PeopleEntity)

- The entities are objects that will match a part of the RDB to a Java Object.

```
import com.fasterxml.jackson.annotation.JsonIgnoreProperties;
@Entity
@JsonIgnoreProperties({"hibernateLazyInitializer", "handler"})
@Table(name="people")
public class PeopleEntity implements Serializable{
```

PeopleEntity

```java
@Id
@Column(name = "playerid", nullable = false, unique = true)
private String playerId;

@Column(name="namefirst" )
private String nameFirst;

@Column(name="namelast")
private String nameLast;

@Column(name="birthcity")
private String birthCity;

@Column(name="birthcountry")
private String birthContry;

@Column(name="birthday")
private String birthDay;

@Column(name="birthmonth")
private String birthMonth;

@Column(name="birthyear")
private String birthYear;
```

Batting Entity

- Every player has a yearly batting statistics

```
@Entity
@IdClass(BattingKey.class)
@JsonIgnoreProperties({"hibernateLazyInitializer", "handler"})
@Table(name="batting")
public class Batting implements Serializable{
private static final long serialVersionUID = 1L;
@Id
@Column(name = "playerid", nullable = false)
private String playerId;
@Id
@Column(name = "yearid", nullable = false)
private int yearId;
@Id
@Column(name = "stint")
private String stint;
@Id
@Column(name = "teamid", nullable = false)
private String teamId;
@Column(name="sf")
private int sacrificeFly;
@Column(name="gidp")
private int groundInDoublePlay;
```

```
@Column(name="lgid")
private String lgId;
@Column(name="G")
private int games;
@Column(name="ab")
private int atBat;
@Column(name="r")
private int runs;
@Column(name="h")
private int hits;
@Column(name="2b")
private int
doubleHits;
@Column(name="3b")
private int
tripeHits;
@Column(name = "hr")
```

```
private int homeRuns;
@Column(name = "rbi")
private int runsBattedIn;
@Column(name = "sb")
private int stolenBases;
@Column(name = "cs")
private int caughtStealing;
@Column(name = "bb")
private int baseOnBalls;
@Column(name = "so")
private int strikedut;
@Column(name = "ibb")
private int
intentionalBaseOnBalls;
@Column(name="hbp")
private int hitByPitch;
@Column(name="sh")
private int sacrificeHit;
```

Queries

```
package com.beisbolicos.playerStats.repo;
import org.springframework.stereotype.Repository;
import com.beisbolicos.playerStats.entity.People;
import java.util.List;
import org.springframework.data.jpa.repository.JpaRepository;
import org.springframework.data.jpa.repository.Query;
@Repository
public interface PeopleRepository extends JpaRepository<People, String>{
@Query("select p  from People p, Batting b where p.playerId=b.playerId and
b.teamId = ?1 and b.yearId = ?2")
public List<People> findByTeamYear(String teamId, int yearId);
}
```

Using the entities and repositories

```
import java.util.List;

import javax.persistence.EntityNotFoundException;
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.stereotype.Service;
import com.beisbolicos.playerStats.entity.People;
import com.beisbolicos.playerStats.repo.PeopleRepository;
import com.beisbolicos.playerStats.service.IPeopleService;
@Service
public class PeopleService implements IPeopleService {
@Autowired
PeopleRepository peopleRepository;
@Override
public void createPeople(People employee) {
peopleRepository.save(employee);
}
                                    @Override
                                    public void deletePeople(String id) {
                                    peopleRepository.deleteById(id);
                                    }
                                    @Override
                                    public List<People> getPeople() {
                                    List<People> people = peopleRepository.findAll();
                                    return people;
                                    }
                                    public List<People> getPeople(String teamId, int yearId) {
                                    List<People>people = peopleRepository.findByTeamYear(teamId,
                                    yearId);
                                    return people;
                                    }
                                                                    @Override
                                                                    public People getPeopleById(String id) {
                                                                    People people;
                                                                    try {
                                                                    people = peopleRepository.getById(id);
                                                                    }catch (EntityNotFoundException e){
                                                                    people = null;
                                                                    }
                                                                    return people;
                                                                    }

                                                                    @Override
                                                                    public void updatePeople(People employee) {
                                                                    peopleRepository.save(employee);

                                                                    }
```

Displaying the results with the controller (1)

```
import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.http.HttpStatus;
import org.springframework.http.ResponseEntity;
import org.springframework.web.bind.annotation.DeleteMapping;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.PathVariable;
import org.springframework.web.bind.annotation.PostMapping;
import org.springframework.web.bind.annotation.PutMapping;
import org.springframework.web.bind.annotation.RequestBody;
import org.springframework.web.bind.annotation.RestController;

import com.beisbolicos.playerStats.entity.People;
import com.beisbolicos.playerStats.serviceImpl.PeopleService;

import io.swagger.annotations.ApiOperation;
import io.swagger.annotations.ApiResponse;
import io.swagger.annotations.ApiResponses;
import io.swagger.annotations.Example;
import io.swagger.annotations.ExampleProperty;
import io.swagger.annotations.SwaggerDefinition;
import io.swagger.annotations.Tag;

@RestController
@SwaggerDefinition(tags = {@Tag (name="Queries", description="Different kind of queries to the BDB")})

public class PeopleController {
```

Displaying with the controller (2)

```
@Autowired
PeopleService peopleService;

@PostMapping(value = "/people")


public ResponseEntity<Object> createEmployee(@RequestBody People people)
{

peopleService.createPeople(people);
return new ResponseEntity<Object>("Successfully Saved", HttpStatus.OK);
}
```

Displaying with the Controller (3)

```
@GetMapping(value = "/people/{id}")
/**
 * Gets the player data according with the ID
 * @param id Gusually the first 5 letter of the lastname with 2 of the name and 2 digits to avoid collisions
 * @return Player or Manager data
 */
@ApiOperation(value = "Queries a people on the Baseball Data Bank",
              notes = "Queries a people on the Baseball Data Bank")
@ApiResponses(value = {
@ApiResponse(code = 200, message = "Successfully got the people",
examples = @Example(value = @ExampleProperty(mediaType="application/json",
value="{\"playerId\":\"allenjo02\","
+ "\"nameFirst\":\"Johnny\","
+ "\"nameLast\":\"Allen\","
+ "\"birthCity\":\"Lenoir\","
+ "\"birthContry\":\"USA\","
+ "\"birthDay\":\"30\","
+ "\"birthMonth\":\"9\","
+ "\"birthYear\":\"1904\"}"))),
@ApiResponse(code = 404, message = "Player or manager not found"),
@ApiResponse(code = 400, message = "Missing or invalid request body"),
@ApiResponse(code = 500, message = "Internal error")
}
)
public ResponseEntity<Object> getPeople(@PathVariable String id) {

People people = peopleService.getPeopleById(id);
return new ResponseEntity<Object>(people, HttpStatus.OK);
}
```

Displaying with the Controller (4)

```
@PutMapping(value = "/people")
public ResponseEntity<Object> updateEmployee(@RequestBody People people) {

peopleService.updatePeople(people);
return new ResponseEntity<Object>("Successfully Updated", HttpStatus.OK);
}

@DeleteMapping(value = "/people/{id}")
public ResponseEntity<Object> deleteEmployee(@PathVariable String id) {

peopleService.deletePeople(id);
return new ResponseEntity<Object>("Successfully Deleted", HttpStatus.OK);
}
```

Displaying with the Controller (5)

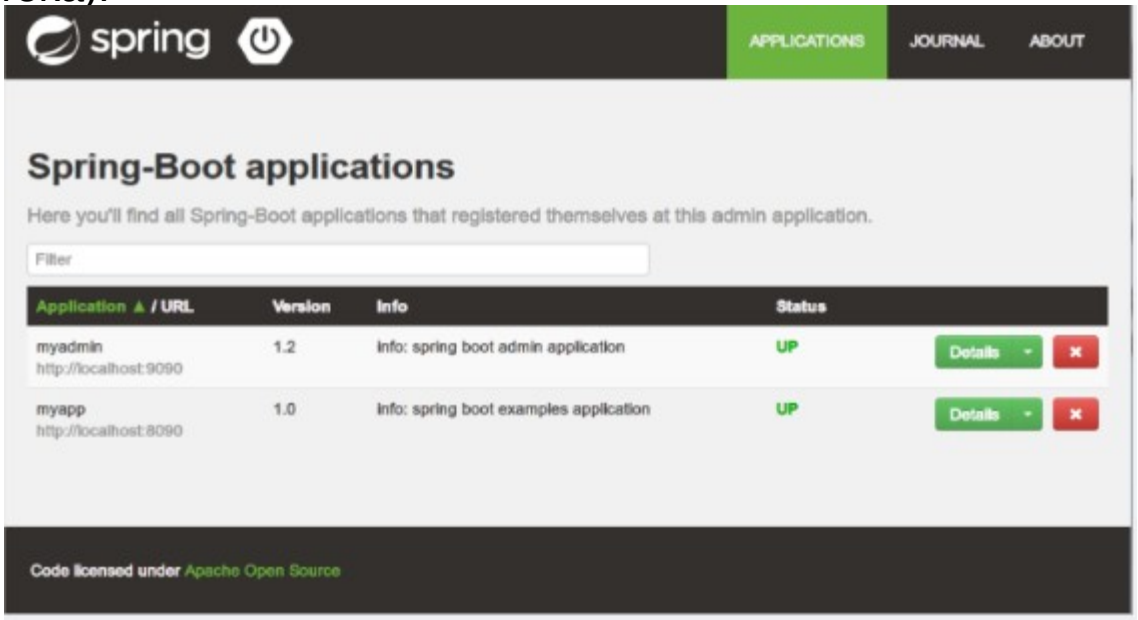
```
@GetMapping(value="/people")
public ResponseEntity <Object> getPeople(){
List<People> people = peopleService.getPeople();
ResponseEntity<Object> listPeople = new ResponseEntity<>(people, HttpStatus.OK);
return listPeople;
}

@GetMapping(value="/people/{teamId}/{yearId}")
public ResponseEntity <Object> getPeople(@PathVariable String teamId, @PathVariable int yearId)
{
List<People> people = peopleService.getPeople(teamId, yearId);
ResponseEntity<Object> listPeople = new ResponseEntity<Object>(people, HttpStatus.OK);
return listPeople;
}

}
```

Exercise 4

- Time to play baseball

Spring boot Administrator

- Spring Boot Admin is a simple application to manage and monitor your Spring Boot Applications.
- The applications register with our Spring Boot Admin Client (via http) or are discovered using Spring Cloud (e.g. Eureka).



Spring boot admin application

- Add spring boot server libraries to project dependencies.
- Create SpringBootAdminApplication

```
<!-- https://mvnrepository.com/artifact/de.codecentric/spring-boot-admin-dependencies -->
<dependency>
    <groupId>de.codecentric</groupId>
    <artifactId>
            spring-boot-admin-dependencies
    </artifactId>
    <version>2.1.1</version>
    <type>pom</type>
</dependency>
```

```
1  package examples.spring.boot.admin;
2
3  import org.springframework.boot.SpringApplication;
8
9  @Configuration
10 @EnableAutoConfiguration
11 @EnableAdminServer
12 public class SpringBootAdminApplication {
13     public static void main(String[] args) {
14         SpringApplication.run(SpringBootAdminApplication.class, args);
15     }
16 }
```

Application properties for the server

```
# ========================
# Tomcat Configuration
# ========================
server.tomcat.max-threads=10
server.address=127.0.0.1
server.port=9090
# ========================
# Security Configuration
# ========================
security.user.name=admin
security.user.password=admin
management.security.role=SUPERU
SER
management.security.enabled=false
```

Adding client to our controller

- Add the maven dependencies

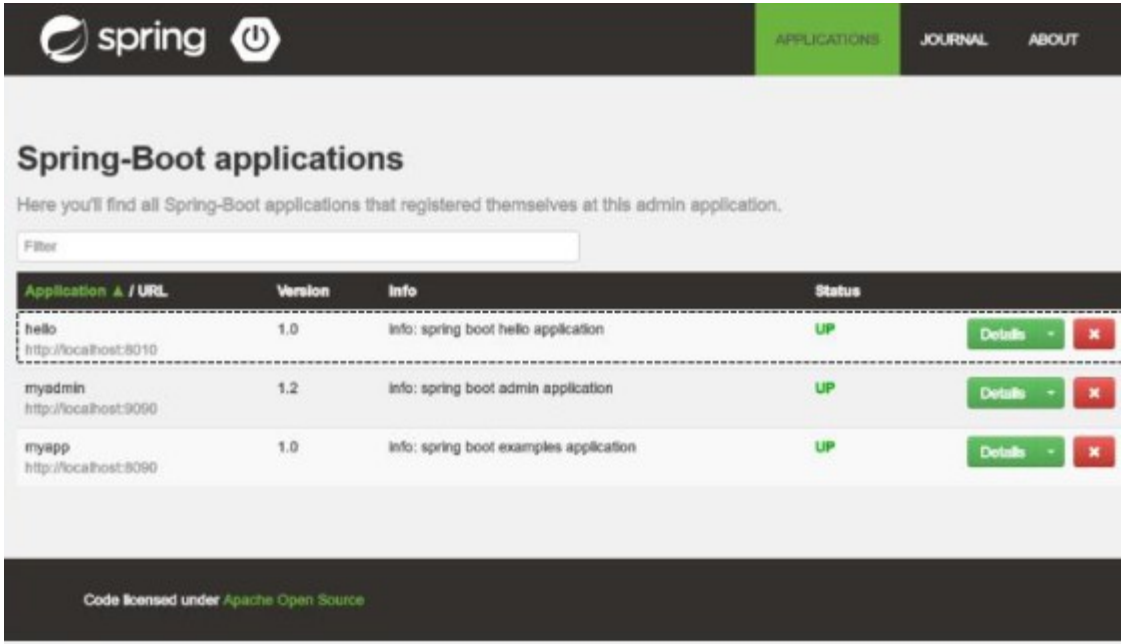
```
<!-- https://mvnrepository.com/artifact/de.codecentric/spring-boot-admin-starter-client --
>
<dependency>
    <groupId>de.codecentric</groupId>
    <artifactId>spring-boot-admin-starter-client</artifactId>
    <version>3.0.0-M3</version>
</dependency>
```

Properties in the application.properties for spring boot client

```
# ======================
# JMX Configuration
#management.port=8011
#management.address=127.0.0.1
management.security.role=SUPERUSER
management.security.enabled=false
# ========================================
# Client Configuration for Spring Boot Admin
info.version=1.0
info.info=spring boot hello application
spring.boot.admin.client.name=hello
spring.boot.admin.url=http://127.0.0.1:9090
spring.boot.admin.username=admin
spring.boot.admin.password=admin
spring.boot.admin.client.health-url=http://localhost:8010/health
spring.boot.admin.client.service-url=http://localhost:8010
spring.boot.admin.client.management-url=http://localhost:8010
```

Spring boot admin checkup

- You don’t need to write code on your Spring boot App (that’s the beauty of Spring Boot)
- Run your Spring boot server
- Run the admin server application



Spring Cloud

- Microservices.Consuming Rest Services

```
@Bean
public RestTemplate restTemplate() {
    return new RestTemplate();
}
public class User {
    private Long id;
    private String username;
    private String firstname;
    private String lastname;
            …..
@Autowired
private RestTemplate restTemplate;
String url = "http://example.org/path/to/api";
User response = restTemplate.getForObject(url, User.class);
User[] response = restTemplate.getForObject(url, User[].class);
```

Kafka

- Kafka is an Open Source QUEUE manager
- QUEUES vs Topics
- JMS
- https://docs.spring.io/spring-kafka/reference/html/

Day 4 summary

- Back-end development introduction
- Spring boot
- REST-Controller
- JPA
- REST client
- Kafka Introduction