SpringBoot

- Purpose: To build java application

  Try to type code with me.

Pre-requisites:
OOP, classes, interfaces, inheritance, exception handling, collection framework

Must have installed:
JDK -> JDK 17 or higher to use springboot 3
IntelliJ IDE

- Provides large number of helper classes and annotations

The Problem with spring:

Traditional spring application building was tedious

Qs

1. Which JAR dependencies do I need?
2. How do I set up configuration? (xml or java)
3. How do I install the server? (Tomcat, JBoss etc)

& this is just getting started

- SpringBoot is the Solution for this
  - Easier for spring development
  - Minimize manual configuration (It performs the auto-configuration)
  - Resolve dependency conflicts
  - Provide an embedded HTTP server

- SpringBoot and Spring
  - SpringBoot uses Spring Behind the scenes.
  - SpringBoot simply makes it easier to use spring.

- Spring Initializer (SpringBoot provides it)

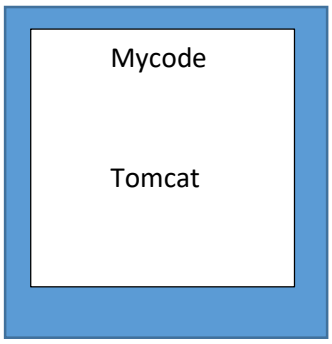
  http://start.spring.io

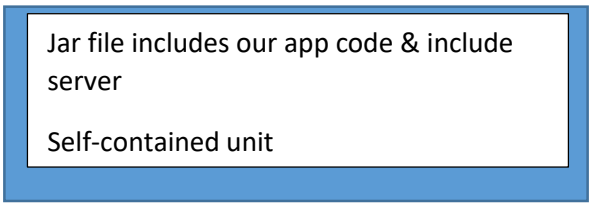
  - Quickly create a starter spring project
  - Select dependencies
  - Select maven/gradle
  - Import project in IDE

- SB Embedded Server
  Provide embedded server
  - Tomcat, JBoss, Undertow

  No need to install server separately

  firstapp.jar





FAQs

1. Does SB replace Spring MVC, Spring REST..?
   No, Instead it uses these technologies

2. Does SB run code faster than regular Spring Code?
   No, SB uses same code of spring framework

Maven:

- When building our project, we may need additional JAR files
  Ex. Spring, Hibernate, JSON etc

  1st Approach:
  Download the JAR files from each project website
  Manually add the JAR files to our build path/classpath

Maven is Solution

- Tell maven the projects we are working with(dependencies)
- Maven will go out and download the JAR files for those projects
- And Maven will make those JAR files available during compile/run
- We can say maven is our helper or personal shopper (shopping list)

Development Process:

1. Configure our project at spring initializer(dependency: Spring Web)
2. Download zip file
3. Unzip the file
4. Import the project into our IDE

Lets Create RestController

```java
package com.flynaut.springboot.demo.firstapp.rest;

import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;

import java.time.LocalDate;

@RestController
public class FunRestController {

    //This method will handle GET request at "hello" endpoint
    @GetMapping("/hello")
    public String sayHello(){
        return "Hello Team!!!!!";
    }

    @GetMapping("/date")
    public LocalDate date(){
        LocalDate localdate= LocalDate.now();
        return localdate;
    }

}
```

URL: Uniform Resource Locator

http://localhost:8080

http://www.abc.com:8080/banking

`http`: Application Layer Protocol (http : hypertext transfer protocol)

`www.abc.com` : DNS qualified host name/IP address(to resolve the host problem)

`8080`: TCP port (to identify the port)

`/banking`: path or URI (Uniform resource identifier)

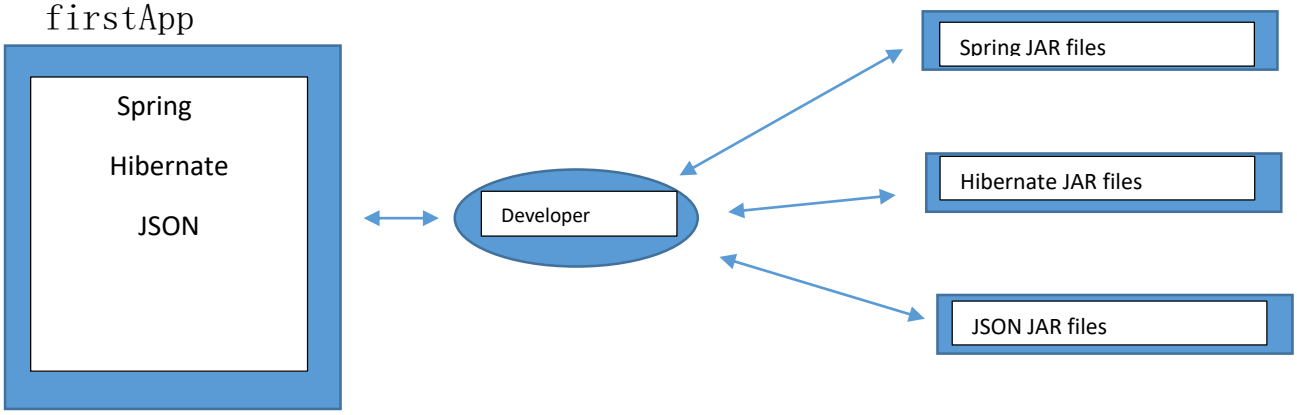
Maven

- What?
  - A project management tool(build tool)
  - Most popular use of Maven is for build management and dependencies

- What problems does maven solve?

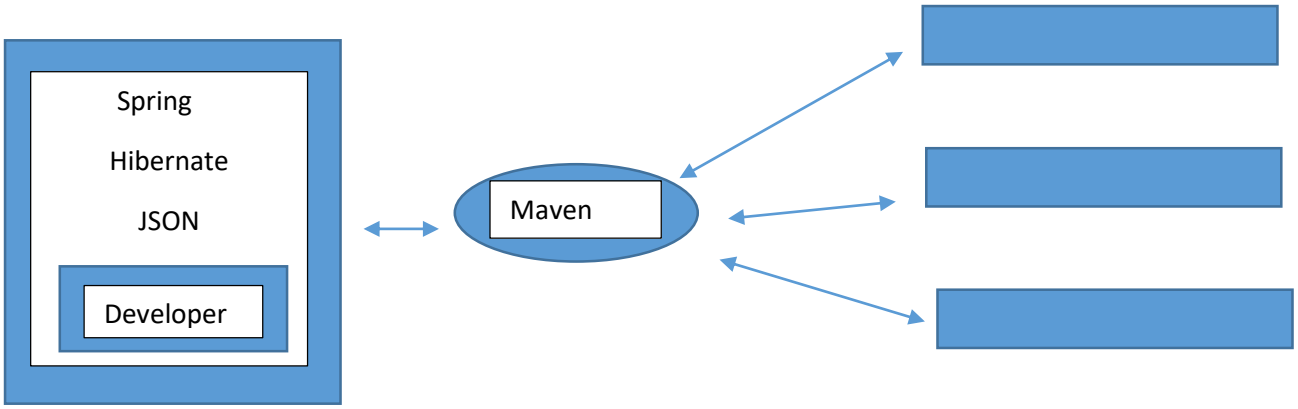
1st Approach - Without using maven

firstApp



2st Approach - With using maven

- Tell maven the projects we are working with (dependencies)
- Go out and download Jar Files for us



- Maven Project Structure

  Maven follows standard directory structure.

  - Normally when we join a new project
  - Every development team used to make their own project directory
  - And this is not ideal for new comers and not standardized

Directory	Description
src/main/java	Our java source code
src/main/resources	Properties/config files used by our app
src/test	Unit testing code and properties
target	Destination directory for compiled code(Automatically created by maven)
pom.xml	Maven configuration file

POM.xml

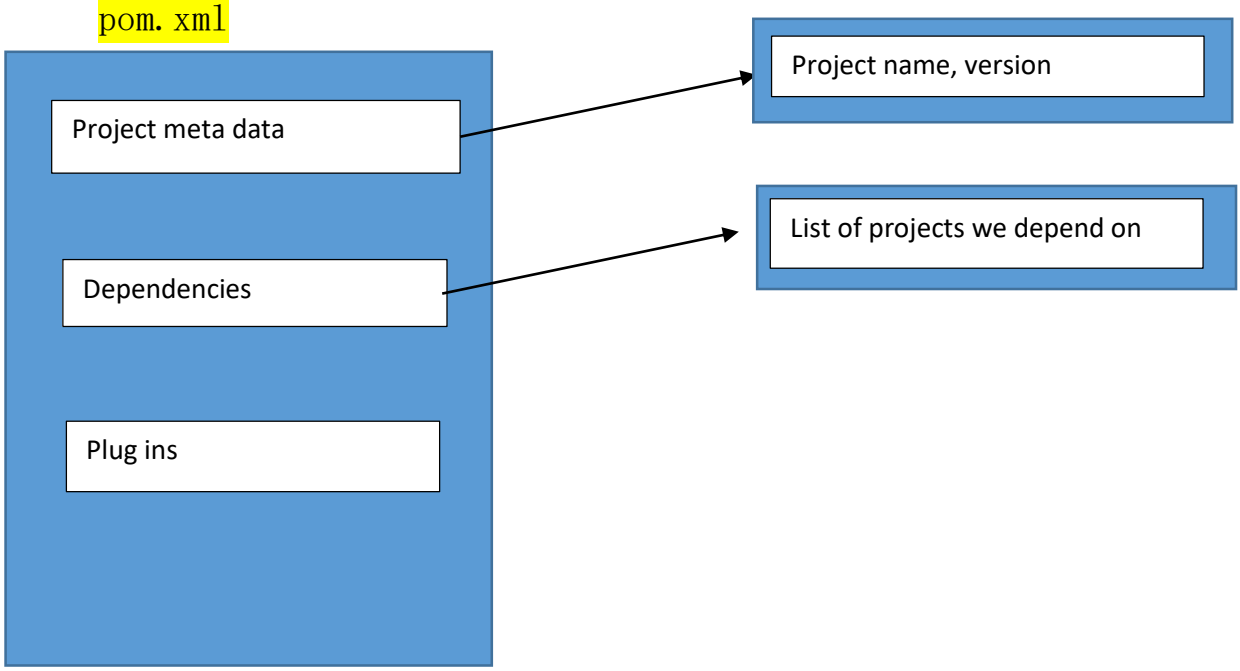
Project Object Model file

- Configuration file for our project
- Basically our "Shopping List" for Maven ☺

Located at root of maven project

- POM file Structure

  pom.xml



- Project Coordinates
  - Project coordinates uniquely identify a project
  - Similar to GPS coordinates for home: latitude/ longitude
  - Precise info for finding our home(city,street,house)

```
<groupId>com.flynaut.springboot.demo</groupId> (City)
<artifactId>firstapp</artifactId>
(Street)
<version>0.0.1-SNAPSHOT</version> (Home No.)
```

GroupId: Name of Company, group, organization

Convention is to use reverse domain name: com.flynaut

ArtifactId: Name for our project: firstapp

Version: A specific release version like: 1.0,2.0

- Adding Dependencies
  - To add dependency we need GAV

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

How to find the dependency coordinates?

1st Way - Visit the project page (spring.io, hibernate.org etc)

2nd Way - Visit Maven Repository: Search/Browse/Explore

Visit Maven Central

SB Project Structure

- Maven Wrapper Files

  mvnw

  mvnw.cmd
  - mvnw allow us to run a maven project
  - No need to have maven installed or present in our path

mvnw.cmd for windows
mvnw.sh for linux/mac

Maven POM file

Pom.xml includes info which we are entering in Spring Initializer

Spring Boot Starters – (A collection of Maven dependencies{compatible versions})

```
org.springframework.boot
```

spring-boot—starter-web -> spring-web
spring-webmvc
tomcat
json

Application Properties

By default, SB will load props from:
application.properties

- Created by Spring Initializer
- Empty at the beginning

We can add SB props in this file

Server.port=7070

To add our own custom properties

coach.name=Prasad

```java
@RestController
public class FunRestController {
    @Value("${coach.name}")
    private String coachName;

    //This method will handle GET request at "hello" endpoint
    @GetMapping("/hello")
    public String sayHello(){
        return coachName;
    }
}
```

In application.properties

```
spring.application.name=firstapp

#Customizing the properties
coach.name=Prasad
```

Task : add one more property in application.properties

Create restcontroller and return that String

- Static Content
  - By default, SB will load static resources from "/static" directory
  - Examples of static resources -> images, HTML files, CSS, JS

- Unit Tests
  SpringBoot Unit Test Class
  Created by Spring Initializer
  We can add unit tests to the file

- Spring Boot Starters
  Building a spring app is really hard

  Why is it hard?
  - It would be great if there is a list of maven dependencies
  - Collected as group of dependencies… one-stop shop
  - So we don’t have to search for each dependency

- The Solution – SB Starter
  - A curated list of maven dependencies
  - A collection of dependencies grouped together
  - Tested by SB team
  - It makes much easier for the developer to get started with spring
  - Reduces the amount of configuration part

- If we are building a Spring app that needs: web, security

Simply select the dependencies in the SI

It will add the appropriate SB starter to our pom.xml

Name	Desc
spring-boot-starter-web	Building web apps, includes validation, REST Uses Tomcat as default embeddedserver
spring-boot-starter-security	Adding spring boot security support
spring-boot-starter-jpa	Spring database support with JPA & Hibernate

What is in the starter?

Select View -> Tool Windows -> maven -> dependencies

SpringBoot Dev Tools

The Problem:

- When running SB app
- If we make changes to our source code
- Then manually we have to restart the application ☹

Solution: SpringBoot Dev Tools

- Automatically restarts the our application when we update the code

- Simply add the dependency to our POM file

Step 1: add this dependency in your pom.xml

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

Step 2:

Settings/Preferences -> build,execution,deployment -> Compiler

Checkbox =build project automatically

Step 3:

Settings/Preferences -> Advanced Setting -> Allow auto-make……

SpringBoot Actuator

The Problem?

How can we monitor and manage my application?

How can I check the health of the application?

Solution: SB Actuator

- Exposes endpoints to monitor and manage our application
- REST endpoints are automatically added to our application

No need to write additional code

- Add dependency to our pom.xml file

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

- All endpoints will be prefixed with: /actuator

/health -> To get health information about our application

localhost:8080/actuator/health

- The /info endpoint can provide information about out application

To expose info:

We need to make changes in application.properties

What about Security?

DAY3

/actuator/threaddump

➔ Listing all the threads running in our application
➔ Useful for analyzing the performance of our web application

/actuator/mappings

➔ List all the request mappings for our application
➔ Useful for finding out what request mappings are available

Spring Security:

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

We can override the default username and password

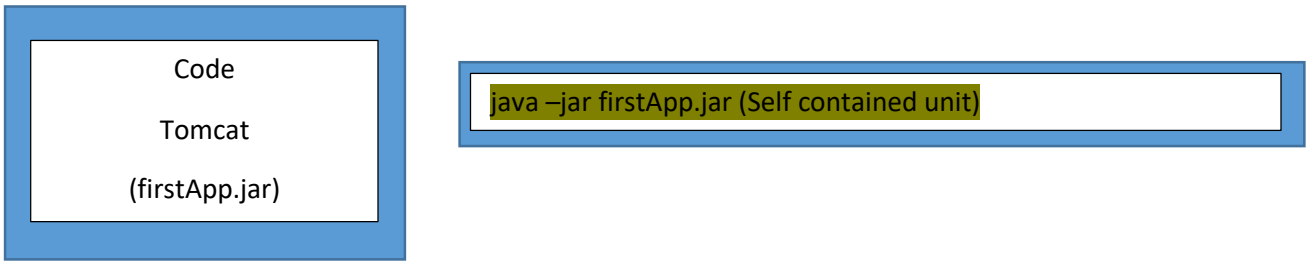
```
spring.security.user.name=Prasad
spring.security.user.password=1234
```

To exclude /health and /info

management.endpoints.web.exposure.exclude=health,info

- Running the SB app from command line

  1st -> Use java -jar <name of our project's JAR file>
  2nd -> Use SB maven plugin
  mvnw spring-boot:run



mvnw package - to generate the jar file of our project(It will be generated in target folder)

SpringBoot Properties

The properties are grouped into the following categories

- Core
- Web
- Security
- Data
- DevTools
- Testing
- Actuator

Web Properties

- Http server port
  server.port=7878

- To change the context path of our application
  server.servlet.context-path=/mypath

- Default HTTP session timeout
  Server.servlet.session.timeout=15m (15 minutes)
  Default timeout is 30 minutes

- Data properties

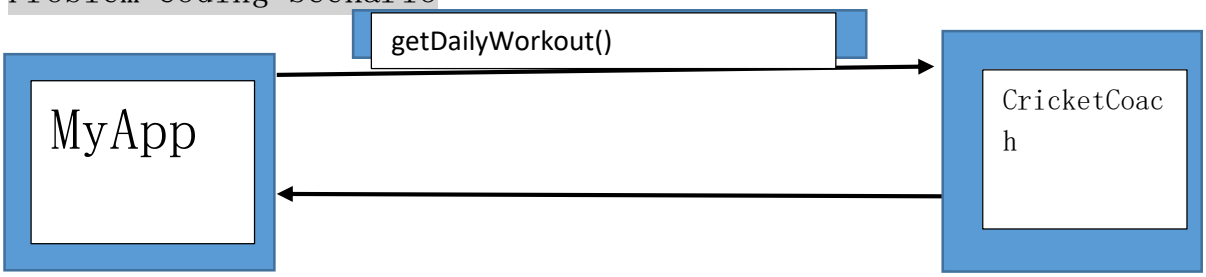
```
# login username of the database
spring.datasource.username=Prasad

# login password of the database
spring.datasource.password=root123
```

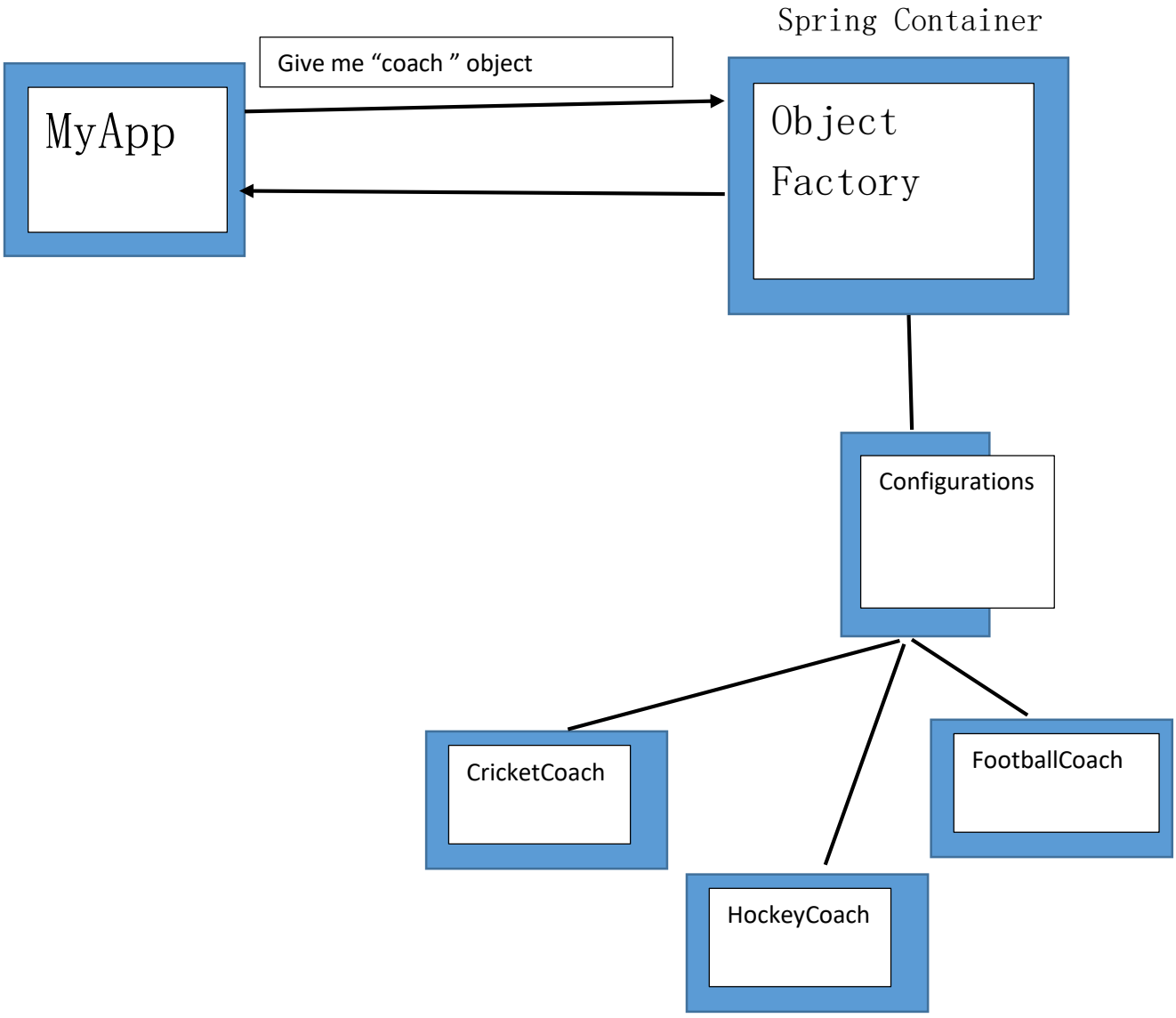
Inversion of Control

The approach of outsourcing the construction and management of objects.

Problem Coding Scenario



Application should be configurable

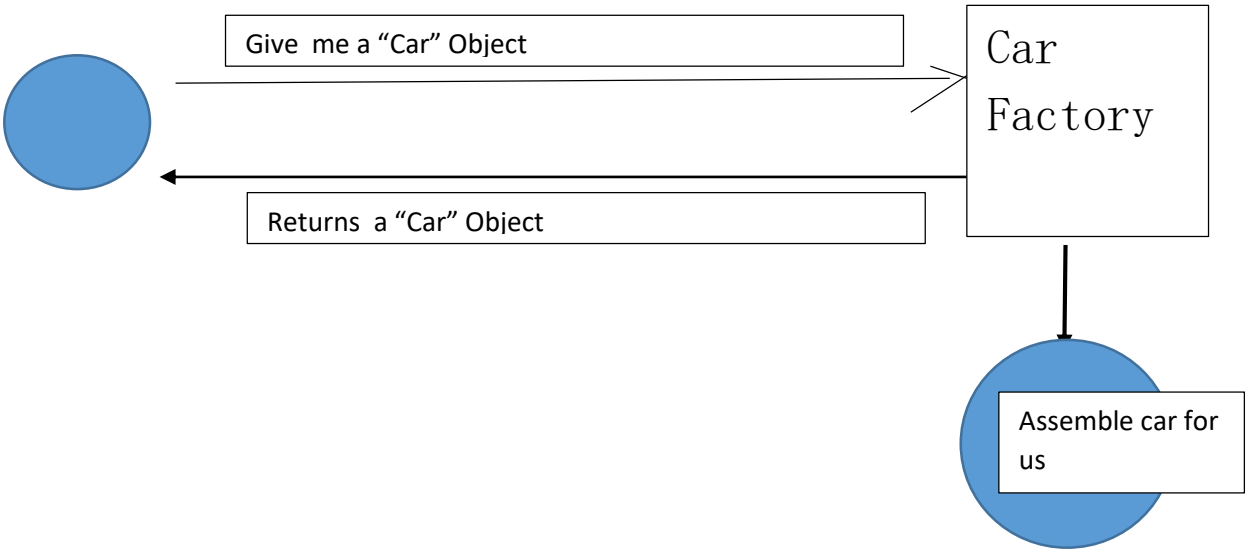


- Spring Container
  - Primary Function
    1. Create and Manage (Inversion of Control)
    2. Inject object dependency (Dependency Injection)

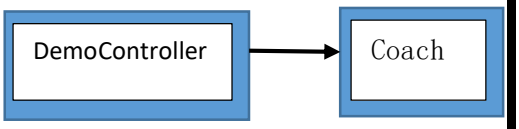
- How do we configure Spring Container?
  - XML configuration file(legacy)
  - Java Annotations(modern)

- Spring Dependency Injection

  The dependency inversion principle
  The client delegates to another object
  The responsibility of providing its dependencies



- Demo Example
  - Coach will provide daily workouts
  - The DemoController wants to use the Coach
    1. New Helper: Coach
    2. This is a dependency
  - Need to inject this dependency into the controller



- Injection Types
  - There are many types of injection with spring
  - Will cover only two recommended types
    1. Constructor Injection
    2. Setter Injection

When to use each?

- Constructor injection
  - use it when you have all the required dependencies

- Setter Injection
  - Use this when we have some optional dependencies

What is Spring Autowiring?

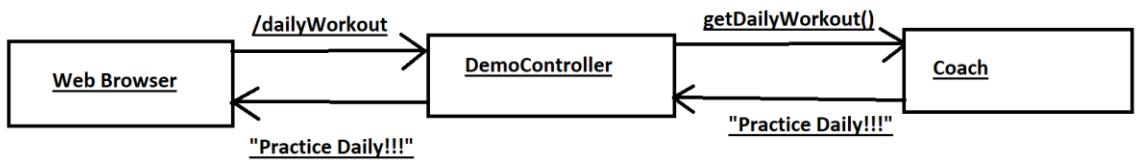
- For dependency injection, spring uses autowiring

- Autowiring example

Injecting a Coach interface

1. Spring will scan for @Components or a class which is annotated with @Components
2. Will ask does any one implements the coach interface??
3. If so, let's inject them. For Ex. CricketCoach

Example Application



- Development Process for constructor injection

1. Define the dependency interface and class

```
package com.flynaut.injection.spring_boot_injection;

public interface Coach {
    String getDailyWorkout();
}
```

```
package com.flynaut.injection.spring_boot_injection;

import org.springframework.stereotype.Component;

@Component
public class CricketCoach implements Coach{
    @Override
    public String getDailyWorkout() {
        return "Practice Practice and Practice";
    }
}
```

2. Create DemoController
3. Create a constructor in our class for injections

```
package com.flynaut.injection.spring_boot_injection;

import
org.springframework.beans.factory.annotation.Autowired;
import
org.springframework.web.bind.annotation.GetMapping;
import
org.springframework.web.bind.annotation.RestController;

@RestController
public class DemoController {

    private Coach myCoach;

    @Autowired
    public DemoController(Coach theCoach){
        myCoach=theCoach;
    }

    @GetMapping("/dailyWorkout")
    public String getDailyWorkout(){
        return myCoach.getDailyWorkout();
    }
}
```

4. Add @GetMapping for /dailyWorkout

@Component Annotation

- Marks the class as Spring Bean
- A spring bean is just a class that is managed by Spring
- Also makes the bean available for DI

- Constructor Injection Behind the Scenes

  How Spring Processes our SB App

  BTS Spring will create the instance of our Coach class

  How?
  Coach theCoach = new CricketCoach();
  DemoController DemoController = new
  DemoController(theCoach);
  This way Constructor Injection Happens

  Spring is more than just IOC & DI

  Spring is for Enterprise Application

  Spring Provides features like:

  1. Database access and transactions
  2. REST APIs
  3. Security

- Component Scanning
  - Scanning for component classes
  - Spring will scan our java classes for annotations @Component
- `@SpringBootApplication`
  Enables -
  - Auto Configuration
  - Component Scanning
  - Additional Configuration

Composed of following annotations:

@EnableAutoConfiguration -> Enable’s SB’s Auto Configuration Support

@ComponentScan -> Enables component scanning of current package also sub-packages

@Configuration -> able to register some extra beans with @Bean

BTS

Creates application context & registers all beans

Starts the embedded server Tomcat

- By default, SB starts component scanning
  - From the same package as our main SB application
  - Also scans sub-packages

Setter Injection

Inject dependencies by calling setter methods on our class.

Dev Process:

1. Create setter methods in our class for injection
2. Configure the dependency injection with @Autowired

BTS:(Setter Injection)

What Spring framework?

Coach theCoach = new CricketCoach();

DemoController demoController = new DemoController();

demoController.setCoach(theCoach);

Field Injection*

Setter Injection Code:

```
package com.flynaut.injection.spring_boot_injection;

import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;
import
com.flynaut.injection.spring_boot_injection.common.Coach;

@RestController
public class DemoController {
    //defined a private field for the dependency
    private Coach myCoach;

    @Autowired
   public void setCoach(Coach theCoach){
       myCoach=theCoach;
   }
```

```
    @GetMapping("/dailyWorkout")
    public String getDailyWorkout(){
        return myCoach.getDailyWorkout();
    }
}
```

- Annotation Autowiring & Qualifiers

Problem:

If we have multiple implementations then spring will get confused which one to use(Ambiguity)

Solution: @Qualifier

```
package com.flynaut.injection.spring_boot_injection;

import org.springframework.beans.factory.annotation.Autowired;
import org.springframework.beans.factory.annotation.Qualifier;
import org.springframework.web.bind.annotation.GetMapping;
import org.springframework.web.bind.annotation.RestController;
import
com.flynaut.injection.spring_boot_injection.common.Coach;

@RestController
public class DemoController {
    //defined a private field for the dependency
    private Coach myCoach;

    @Autowired
   public DemoController(@Qualifier("hockeyCoach") Coach
theCoach){
       myCoach=theCoach;
   }

    @GetMapping("/dailyWorkout")
    public String getDailyWorkout(){
        return myCoach.getDailyWorkout();
    }
}
```

@Primary -> alternative option to @Qualifier

Lazy Initialization*(Discussed)

```
spring.main.lazy-initialization=true
```

Bean Scopes

Scope is nothing but the lifecycle of a bean

Like

1. How long does the bean live?
2. How many instances are going to be created?
3. How is the bean share?

- Default scope is singleton

What is singleton?

- Spring Container creates only one instance of the bean by default.

Prototype*

Request*

Session*

Bean LifeCycle: