Course Introduction

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Main Objective

Learn how to build Java applications with

Spring Boot and Hibernate

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You will learn how to …

- Develop Spring Boot applications
- Leverage Hibernate/JPA for database access
- Develop a REST API using Spring Boot
- Create a Spring MVC app with Spring Boot
- Connect Spring Boot apps to a Database for CRUD development
- Apply Spring Security to control application access
- Leverage all Java configuration (no xml) and Maven

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Source Code and PDFs

All source code is available for download

All PDFs of slides are available for download

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Questions / Help

If you have questions or need help…

Post the question in the classroom discussion forum

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Java Development Environment

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Java Development Environment

- We assume that you are already have experience with Java
  - OOP, classes, interfaces, inheritance, exception handling, collections

- You should have the following items already installed
  - Java Development Kit (JDK) - *Spring Boot 3 requires JDK 17 or higher*
  - Java IDE (we'll use IntelliJ in the videos, but any Java IDE will work)

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About IntelliJ

Super Amazing IDE!!!

- In this course, we will use the free version of IntelliJ
  - Known as **IntelliJ Community Edition**
  - Download from: **https://www.jetbrains.com/idea/download**
  - Select **Community Edition**

- You can also use the Ultimate Edition ($) ... free trial version is available

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Java Development Environment Checkpoint

- You should have the following items already installed
  - Java Development Kit (JDK) - *Spring Boot 3 requires JDK 17 or higher*
  - Java IDE (we'll use IntelliJ in the videos, but any Java IDE will work)

- Before continuing with the course
  - Make sure you can run a basic HelloWorld Java app in your Java IDE

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Spring Boot Introduction

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Spring in a Nutshell

- Very popular framework for building Java applications
- Provides a large number of helper classes and annotations

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The Problem

- Building a traditional Spring application is really HARD!!!

Q: Which JAR dependencies do I need?

Q: How do I set up configuration (xml or Java)?

Q: How do I install the server? (Tomcat, JBoss etc…)

And that's JUST the basics for getting started

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Spring Boot Solution

- Make it easier to get started with Spring development
- Minimize the amount of manual configuration
  - Perform auto-configuration based on props files and JAR classpath
- Help to resolve dependency conflicts (Maven or Gradle)
- Provide an embedded HTTP server so you can get started quickly
  - Tomcat, Jetty, Undertow, …

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Spring Boot and Spring

- Spring Boot uses Spring behind the scenes
- Spring Boot simply makes it easier to use Spring

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Spring Initializr

- Quickly create a starter Spring Boot project
- Select your dependencies
- Creates a Maven/Gradle project
- Import the project into your IDE
  - Eclipse, IntelliJ, NetBeans etc …

http://start.spring.io

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Spring Boot Embedded Server

- Provide an embedded HTTP server so you can get started quickly
  - Tomcat, Jetty, Undertow, …
- No need to install a server separately

Self-contained unit
Nothing else to install

JAR file
includes your application code
AND
includes the server

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Running Spring Boot Apps

- Spring Boot apps can be run standalone (includes embedded server)
- Run the Spring Boot app from the IDE or command-line

```
> java -jar mycoolapp.jar
```

Name of our JAR file

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Deploying Spring Boot Apps

- Spring Boot apps can also be deployed in the traditional way
- Deploy **Web Application Archive (WAR) file** to an external server:
  - Tomcat, JBoss, WebSphere etc …

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Spring Boot FAQ #1

Q: Does Spring Boot replace Spring MVC, Spring REST etc …?

- No. Instead, Spring Boot actually uses those technologies

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Spring Boot FAQ #2

Q: Does Spring Boot run code faster than regular Spring code?

- No.
- Behind the scenes, Spring Boot uses same code of Spring Framework
- Remember, Spring Boot is about making it easier to get started
  - Minimizing configuration etc …

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Spring Boot FAQ #3

Q: Do I need a special IDE for Spring Boot?

- No.
- You can use any IDE for Spring Boot apps … even use plain text editor
- The Spring team provides free *Spring Tool Suite (STS)* [IDE plugins]
- Some IDEs provide fancy Spring tooling support
- Not a requirement. Feel free to use the IDE that works best for you 😄

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Spring Boot Initializr Demo

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Spring Initializr

- Quickly create a starter Spring project
- Select your dependencies
- Creates a Maven/Gradle project
- Import the project into your IDE
  - Eclipse, IntelliJ, NetBeans etc …

http://start.spring.io

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Quick Word on Maven

- When building your Java project, you may need additional JAR files
  - For example: Spring, Hibernate, Commons Logging, JSON etc…
- One approach is to download the JAR files from each project web site
- Manually add the JAR files to your build path / classpath

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Maven Solution

- Tell Maven the projects you are working with (dependencies)
  - Spring, Hibernate etc ….
- Maven will go out and download the JAR files for those projects for you
- And Maven will make those JAR files available during compile/run
- Think of Maven as your friendly helper / personal shopper :-)

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Development Process

Step-By-Step

1. Configure our project at Spring Initializr website `http://start.spring.io`

2. Download the zip file

3. Unzip the file

4. Import the project into our IDE

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Spring Boot - Create REST Controller

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REST Controller

- Let's create a very simple REST Controller

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Create REST Controller

Set up rest controller

```
@RestController
public class FunRestController {

  // expose "/" that returns "Hello World"

  @GetMapping("/")
  public String sayHello() {
    return "Hello World!";
  }

}
```

Handle HTTP GET requests

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Spring Projects

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What Are Spring "Projects"

- Additional Spring ***modules*** built-on top of the core Spring Framework
- Only use what you need …
  - Spring Cloud, Spring Data
  - Spring Batch, Spring Security
  - Spring Web Services, Spring LDAP
  - *others …*

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Spring Projects

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Maven Crash Course

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Spring Boot and Maven

- When you generate projects using Spring Initializr: start.spring.io
  - It can generate a Maven project for you

- In this section, we will learn the basics of Maven
  - Viewing dependencies in the Maven pom.xml file
  - Spring Boot Starters for Maven

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What is Maven?

- Maven is a Project Management tool
- Most popular use of Maven is for build management and dependencies

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What Problems Does Maven Solve?

- When building your Java project, you may need additional JAR files
  - For example: Spring, Hibernate, Commons Logging, JSON etc…
- One approach is to download the JAR files from each project web site
- Manually add the JAR files to your build path / classpath

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My Project without Maven

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Maven Solution

- Tell Maven the projects you are working with (dependencies)
  - Spring, Hibernate etc ….
- Maven will go out and download the JAR files for those projects for you
- And Maven will make those JAR files available during compile/run
- Think of Maven as your friendly helper / personal shopper :-)

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My Project with Maven

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Maven - How It Works

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Handling JAR Dependencies

- When Maven retrieves a project dependency
  - It will also download supporting dependencies
  - For example: Spring depends on commons-logging …
- Maven will handle this for us automagically

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Building and Running

- When you build and run your app …
- Maven will handle class / build path for you
- Based on config file, Maven will add JAR files accordingly

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Standard Directory Structure

- Normally when you join a new project
  - Each development team dreams up their own directory structure
  - Not ideal for new comers and not standardized
- Maven solves this problem by providing a standard directory structure

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Standard Directory Structure

Directory	Description
src/main/java	Your Java source code
src/main/resources	Properties / config files used by your app
src/main/webapp	JSP files and web config files other web assets (images, css, js, etc)
src/test	Unit testing code and properties
target	Destination directory for compiled code. Automatically created by Maven

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Standard Directory Structure

Place your Java source code here

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Standard Directory Structure

Place your Web assets here

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Standard Directory Structure Benefits

- For new developers joining a project
  - They can easily find code, properties files, unit tests, web files etc …

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Standard Directory Structure Benefits

- Most major IDEs have built-in support for Maven
  - Eclipse, IntelliJ, NetBeans etc
  - IDEs can easily read/import Maven projects
- Maven projects are portable
  - Developers can easily share projects between IDEs
  - No need to fight about which IDE is the best LOL!

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Advantages of Maven

- Dependency Management
  - Maven will find JAR files for you
  - No more missing JARs
- Building and Running your Project
  - No more build path / classpath issues
- Standard directory structure

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My Personal Best Maven Benefit(s)

- Once you learn Maven, you can join a new project and be productive
- You can build and run a project with minimal local configuration

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Maven Key Concepts

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Maven Key Concepts

- POM File - pom.xml
- Project Coordinates

POM File - pom.xml

- Project Object Model file: POM file
- Configuration file for your project
  - Basically your "shopping list" for Maven :-)

    Tell Maven our project dependencies
- Located in the root of your Maven project

POM File Structure

pom.xml

Project name, version etc
Output file type: JAR, WAR, …

Information about the project

List of projects we depend on
Spring, Hibernate, etc…

Additional custom tasks to run:
generate JUnit test reports etc…

Simple POM File

```
<project ...>

  <modelVersion>4.0.0</modelVersion>

  <groupId>com.luv2code</groupId>
  <artifactId>mycoolapp</artifactId>
  <version>1.0.FINAL</version>
  <packaging>jar</packaging>

  <name>mycoolapp</name>

  <dependencies>
    <dependency>
      <groupId>org.junit.jupiter</groupId>
      <artifactId>junit-jupiter</artifactId>
      <version>5.9.1</version>
      <scope>test</scope>
    </dependency>
  </dependencies>

    <!-- add plugins for customization -->

</project>
```

Project name, version etc
Output file type: JAR, WAR, …

List of projects we depend on
Spring, Hibernate, etc…

Additional custom tasks to run:
generate JUnit test reports etc…

Project Coordinates

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

```
<groupId>com.luv2code</groupId>
<artifactId>mycoolapp</artifactId>
<version>1.0.FINAL</version>
```

City

Street

House Number

Project Coordinates - Elements

Name	Description
Group ID	Name of company, group, or organization. Convention is to use reverse domain name: **com.luv2code**
Artifact ID	Name for this project: **mycoolapp**
Version	A specific release version like: **1.0, 1.6, 2.0** … If project is under active development then: **1.0-SNAPSHOT**

```
<groupId>com.luv2code</groupId>
<artifactId>mycoolapp</artifactId>
<version>1.0.FINAL</version>
```

Example of Project Coordinates

```
<groupId>com.luv2code</groupId>
<artifactId>mycoolapp</artifactId>
<version>1.0.RELEASE</version>
```

```
<groupId>org.springframework</groupId>
<artifactId>spring-context</artifactId>
<version>6.0.0</version>
```

```
<groupId>org.hibernate.orm</groupId>
<artifactId>hibernate-core</artifactId>
<version>6.1.4.Final</version>
```

Adding Dependencies

```
<project ...>
 ...
 <dependencies>

     <dependency>
        <groupId>org.springframework</groupId>
        <artifactId>spring-context</artifactId>
        <version>6.0.0</version>
     </dependency>

     <dependency>
        <groupId>org.hibernate.orm</groupId>
        <artifactId>hibernate-core</artifactId>
        <version>6.1.4.Final</version>
     </dependency>
     ...

 </dependencies>

</project>
```

This information is needed for maven to retrieve the project dependencies

Dependency Coordinates

- To add given dependency project, we need
  - **Group ID**, **Artifact ID**
  - **Version** is optional …
    - Best practice is to include the version (repeatable builds)

DevOps

- May see this referred to as: **GAV**
  - <u>G</u>roup ID, <u>A</u>rtifact ID and <u>V</u>ersion

How to Find Dependency Coordinates

- Option 1: Visit the project page (spring.io, hibernate.org etc)
- Option 2: Visit **`https://central.sonatype.com`** (easiest approach)

Spring Boot Project Structure

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Spring Initializr

- Spring Initializr created a Maven project for us

- Let's explore the project structure

http://start.spring.io

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Maven Standard Directory Structure

Directory	Description
src/main/java	Your Java source code
src/main/resources	Properties / config files used by your app
src/test/java	Unit testing source code

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Maven Wrapper files

- **`mvnw`** allows you to run a Maven project
  - No need to have Maven installed or present on your path
  - If correct version of Maven is NOT found on your computer
    - **Automatically downloads** correct version and runs Maven
- Two files are provided
  - **`mvnw.cmd`** for MS Windows
  - **`mvnw.sh`** for Linux/Mac

```
> mvnw clean compile test
```

```
$ ./mvnw clean compile test
```


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Maven Wrapper files

- If you already have Maven installed previously
  - Then you can ignore/delete the **`mvnw`** files

- Just use Maven as you normally would

```
$ mvn clean compile test
```

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Maven POM file

- **`pom.xml`** includes info that you entered at Spring Initializr website

```
<groupId>com.luv2code.springboot.demo</groupId>
<artifactId>mycoolapp</artifactId>
<version>0.0.1-SNAPSHOT</version>
<packaging>jar</packaging>
```

```
<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>
```

Maven POM file

- **`pom.xml`** includes info that you entered at

```
<groupId>com.luv2code.springbo
<artifactId>mycoolapp</artifact
<version>0.0.1-SNAPSHOT</versi
<packaging>jar</packaging>
```

Spring Boot Starters

A collection of Maven dependencies (Compatible versions)

```
<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>
```

Maven POM file

- **`pom.xml`** includes info that you entered at Spring Initializr website

```
<groupId>com.luv2code.springboot.demo</groupId>
<artifactId>mycoolapp</artifactId>
<version>0.0.1-SNAPSHOT</version>
<packaging>jar</packaging>
```

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

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

spring-web
spring-webmvc
hibernate-validator
tomcat
json
…

Maven POM file

- **`pom.xml`** includes info that you entered at Spring Initializr website

```
<groupId>com.luv2code.springboot.demo</groupId>
<artifactId>mycoolapp</artifactId>
<version>0.0.1-SNAPSHOT</version>
<packaging>jar</packaging>
```

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

                                  nework.boot</groupId>
                                  t-starter-test</artifactId>

  </dependency>
  ...
</dependencies>
```

Save's the developer from having to list all of the individual dependencies

Also, makes sure you have compatible versions

Maven POM file

- Spring Boot Maven plugin

  To package and run the app

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

To package executable jar
or war archive

Can also easily run the app

```
$ ./mvnw package

$ ./mvnw spring-boot:run
```

Can also just use:

mvn package
mvn spring-boot:run

If maven has already installed in your computer

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Java Source Code

Main Spring Boot application class

Created by Spring Initializr

RestController that we created in an earlier video

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Application Properties

- By default, Spring Boot will load properties from: **`application.properties`**

Created by Spring Initializr

Empty at the beginning

Can add Spring Boot properties
`server.port=8585`

Also add your own custom properties
`coach.name=Mickey Mouse`

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Application Properties

- Read data from: **`application.properties`**

  Make use of injection - inject inside our code

```
# configure server port
server.port=8484

# configure my props
coach.name=Mickey Mouse
team.name=The Mouse Crew
```

```
@RestController
public class FunRestController {

  @Value("${coach.name}")
  private String coachName;

  @Value("${team.name}")
  private String teamName;

  ...
}
```


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Static Content

By default, Spring Boot will load static resources from "/static" directory

Examples of static resources
HTML files, CSS, JavaScript, images, etc …

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Static Content

WARNING:

Do not use the `src/main/webapp` directory if your application is packaged as a JAR.

Although this is a standard Maven directory, it works only with WAR packaging.

It is silently ignored by most build tools if you generate a JAR.

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Templates

- Spring Boot includes auto-configuration for following template engines
  - FreeMarker
  - Thymeleaf
  - Mustache

By default, Spring Boot will load templates from "/templates" directory

Thymeleaf is a popular template engine
We will use it later in the course

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Unit Tests

Spring Boot unit test class

Created by Spring Initializr

You can add unit tests to the file

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Spring Boot Starters

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The Problem

- Building a Spring application is really HARD!!!

FAQ: Which Maven dependencies do I need?

Hi, I want to know the minimum required Maven Dependencies for Spring MVC + Hibernate connection.
· Lecture 314 · 3 days ago

if we use pom . What are the exact dependencies
· Lecture 268 · 19 days ago

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The Problem

```
<!-- Spring support -->
<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-webmvc</artifactId>
    <version>6.0.0-RC1</version>
</dependency>

<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-tx</artifactId>
    <version>6.0.0-RC1</version>
</dependency>

<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-orm</artifactId>
    <version>6.0.0-RC1</version>
</dependency>
```

Spring version

```
<!-- Spring Security -->
<dependency>
    <groupId>org.springframework.security</groupId>
    <artifactId>spring-security-web</artifactId>
    <version>6.0.0-RC1</version>
</dependency>

<!-- Hibernate ORM -->
<dependency>
    <groupId>org.hibernate.orm</groupId>
    <artifactId>hibernate-core</artifactId>
    .1.4.Final</version>

Validator -->

g.hibernate.validator</groupId>
hibernate-validator</artifactId>
    <version>7.0.5.Final</version>
</dependency>
```

Which versions are compatible?

Very error-prone

Easy to make a simple mistake

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Why Is It So Hard?

- It would be great if there was a simple list of Maven dependencies
- Collected as a group of dependencies … one-stop shop
- So I don't have to search for each dependency

There should be an easier solution

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The Solution - Spring Boot Starters

- **Spring Boot Starters**
- A curated list of Maven dependencies
- A collection of dependencies grouped together
- Tested and verified by the Spring Development team
- Makes it much easier for the developer to get started with Spring
- Reduces the amount of Maven configuration

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Spring MVC

- For example, when building a Spring MVC app, you normally need

```
<!-- Spring support -->
<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-webmvc</artifactId>
    <version>6.0.0-RC1</version>
</dependency>

<!-- Hibernate Validator -->
<dependency>
    <groupId>org.hibernate.validator</groupId>
    <artifactId>hibernate-validator</artifactId>
    <version>7.0.5.Final</version>
</dependency>

<!-- Web template: Thymeleaf -->
<dependency>
    <groupId>org.thymeleaf</groupId>
    <artifactId>thymeleaf</artifactId>
    <version>3.0.15.RELEASE</version>
</dependency>
```


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Solution: Spring Boot Starter - Web

- Spring Boot provides: **`spring-boot-starter-web`**

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

Spring Boot Starters

A collection of Maven dependencies (Compatible versions)

CONTAINS
spring-web
spring-webmvc
hibernate-validator
json
tomcat
...

Save's the developer from having to list all of the individual dependencies

Also, makes sure you have compatible versions

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Spring Initializr

- In Spring Initializr, simply select **Web** dependency
- You automatically get **`spring-boot-starter-web`** in **`pom.xml`**

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Spring Initializr

- If we are building a Spring app that needs: Web, Security, …
- Simply select the dependencies in the Spring Initializr
- It will add the appropriate Spring Boot starters to your **`pom.xml`**

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Spring Initializr

Dependencies ADD ... ⌘ + B

Spring Web WEB
Build web, including RESTful, applications using Spring MVC. Uses Apache Tomcat as the default embedded container.

Spring Security SECURITY
Highly customizable authentication and access-control framework for Spring applications.

Spring Data JPA SQL
Persist data in SQL stores with Java Persistence API using Spring Data and Hibernate.

Thymeleaf TEMPLATE ENGINES
A modern server-side Java template engine for both web and standalone environments. Allows HTML to be correctly displayed in browsers and as static prototypes.

File: pom.xml

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

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

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

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


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Spring Boot Starters

- There are 30+ Spring Boot Starters from the Spring Development team

Name	Description
`spring-boot-starter-web`	**Building web apps, includes validation, REST. Uses Tomcat as default embedded server**
`spring-boot-starter-security`	**Adding Spring Security support**
`spring-boot-starter-data-jpa`	**Spring database support with JPA and Hibernate**
...	

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Spring Boot Starters

Full list

www.luv2code.com/spring-boot-starters

Name	Description
spring-boot-starter	Core starter, including a
spring-boot-starter-activemq	Starter for JMS messag
spring-boot-starter-amqp	Starter for using Spring
spring-boot-starter-aop	Starter for aspect-orient
spring-boot-starter-artemis	Starter for JMS messag
spring-boot-starter-batch	Starter for using Spring
spring-boot-starter-cache	Starter for using Spring

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What Is In the Starter?

- FAQ: What is in **`spring-boot-starter-xyz`**?

- View the starter's POM file

  www.luv2code.com/spring-boot-starters

  - Normally references other starters … so you will need to dig a bit
  - Somewhat cumbersome …

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What Is In the Starter?

- Most IDEs have a Dependency Management / View feature
  - Much easier to navigate
  - I'll show you how to do this with Eclipse and IntelliJ

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What Is In the Starter?

- For Eclipse Users
- Open the pom.xml
- Select the tab **Dependency Hierarchy**
- Expand the desired starter

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What Is In the Starter?

- For IntelliJ users
- Select **View > Tool Windows > Maven Projects > Dependencies**

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Spring Boot Starter Parent

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Spring Boot Starter Parent

- Spring Boot provides a "Starter Parent"
- This is a special starter that provides Maven defaults

```
<parent>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-starter-parent</artifactId>
  <version>3.0.0-RC1</version>
  <relativePath/> <!-- lookup parent from repository -->
</parent>
```

Included in pom.xml when using Spring Initializr

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Spring Boot Starter Parent

- Maven defaults defined in the Starter Parent
  - Default compiler level
  - UTF-8 source encoding
  - *Others …*

```
<parent>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-starter-parent</artifactId>
  <version>3.0.0-RC1</version>
  <relativePath/> <!-- lookup parent from repository -->
</parent>
```


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Spring Boot Starter Parent

- To override a default, set as a property

```
<properties>
  <java.version>17</java.version>
</properties>
```

Specify your Java version

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Spring Boot Starter Parent

- For the **`spring-boot-starter-*`** dependencies, no need to list version

```
<parent>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-starter-parent</artifactId>
  <version>3.0.0-RC1</version>
  <relativePath/> <!-- lookup parent from repository -->
</parent>
```

Specify version of Spring Boot

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

Inherit version from Starter Parent

No need to list individual versions
Great for maintenance!

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Spring Boot Starter Parent

- Default configuration of Spring Boot plugin

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

```
> mvn spring-boot:run
```


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Benefits of the Spring Boot Starter Parent

- Default Maven configuration: Java version, UTF-encoding etc
- Dependency management
  - Use version on parent only
  - `spring-boot-starter-*` dependencies inherit version from parent
- Default configuration of Spring Boot plugin

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Spring Boot Dev Tools

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The Problem

- When running Spring Boot applications
  - If you make changes to your source code
  - Then you have to manually restart your application :-(

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Solution: Spring Boot Dev Tools

- **`spring-boot-devtools`** to the rescue!
- Automatically restarts your application when code is updated
- Simply add the dependency to your POM file
- No need to write additional code :-)
- For IntelliJ, need to set additional configurations ... will discuss shortly

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Spring Boot Dev Tools

- Adding the dependency to your POM file

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

Automatically restarts your application when code is updated

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IntelliJ Community Edition - DevTools

- IntelliJ Community Edition does not support DevTools by default
- Select: **Preferences > Build, Execution, Deployment > Compiler**
  - Check box: **Build project automatically**

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IntelliJ Community Edition

- Additional setting
- Select: **Preferences > Advanced Settings**
  - Check box: **Allow auto-make to ...**

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Development Process

Step-By-Step

1. Apply IntelliJ configurations

2. Edit **`pom.xml`** and add **`spring-boot-devtools`**

3. Add new REST endpoint to our app

4. Verify the app is automatically reloaded

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Spring Boot DevTools Documentation

For more details

www.luv2code.com/devtools-docs

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Spring Boot Actuator

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Problem

- How can I monitor and manage my application?
- How can I check the application health?
- How can I access application metrics?

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Solution: Spring Boot Actuator

- Exposes endpoints to monitor and manage your application
- You easily get DevOps functionality out-of-the-box
- Simply add the dependency to your POM file
- REST endpoints are automatically added to your application

No need to write additional code!

You get new REST endpoints for FREE!

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Spring Boot Actuator

- Adding the dependency to your POM file

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


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Spring Boot Actuator

- Automatically exposes endpoints for metrics out-of-the-box
- Endpoints are prefixed with: **`/actuator`**

Name	Description
`/health`	**Health information about your application**
...	

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Health Endpoint

- **`/health`** checks the status of your application
- Normally used by monitoring apps to see if your app is up or down

Health status is customizable based on your own business logic

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Exposing Endpoints

- By default, only **`/health`** is exposed
- The **`/info`** endpoint can provide information about your application
- To expose **`/info`**

File: src/main/resources/application.properties

```
management.endpoints.web.exposure.include=health,info
management.info.env.enabled=true
```


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Info Endpoint

- `/info` gives information about your application
- Default is empty

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Info Endpoint

- Update **`application.properties`** with your app info

File: src/main/resources/application.properties

```
info.app.name=My Super Cool App
info.app.description=A crazy and fun app, yoohoo!
info.app.version=1.0.0
```

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Spring Boot Actuator Endpoints

- There are 10+ Spring Boot Actuator endpoints

Name	Description
`/auditevents`	**Audit events for your application**
`/beans`	**List of all beans registered in the Spring application context**
`/mappings`	**List of all @RequestMapping paths**
...	

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Spring Boot Actuator Endpoints

Full list

www.luv2code.com/actuator-endpoints

ID	Description
`auditevents`	Exposes audit events information for the current applic
`beans`	Displays a complete list of all the Spring beans in your
`caches`	Exposes available caches.
`conditions`	Shows the conditions that were evaluated on configura or did not match.
`configprops`	Displays a collated list of all `@ConfigurationPrope`
`env`	Exposes properties from Spring's `ConfigurableEnv`

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Exposing Endpoints

- By default, only **`/health`** is exposed
- To expose all actuator endpoints over HTTP

File: src/main/resources/application.properties

```
# Use wildcard "*" to expose all endpoints
# Can also expose individual endpoints with a comma-delimited list
#
management.endpoints.web.exposure.include=*
```


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Get A List of Beans

- Access **`http://localhost:8080/actuator/beans`**


```
{
  "contexts": {
    "application": {
      "beans": {
        "endpointCachingOperationInvokerAdvisor": {
          "aliases": [],
          "scope": "singleton",
          "type": "org.springframework.boot.actuate.endpoint.invoker.cache.Cach
          "resource": "class path resource [org/springframework/boot/actuate/au
          "dependencies": [
            "environment"
          ]
        },
        "defaultServletHandlerMapping": {
          "aliases": [],
          "scope": "singleton",
          "type": "org.springframework.web.servlet.HandlerMapping",
          "resource": "class path resource [org/springframework/boot/autoconfig
          "dependencies": []
        },
        "org.springframework.boot.autoconfigure.web.servlet.WebMvcAutoConfigura
          "aliases": [],
          "scope": "singleton",
          "type":
```


What about security??

We'll add security in later videos

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Development Process

Step-By-Step

1. Edit **`pom.xml`** and add **`spring-boot-starter-acuator`**

2. View actuator endpoints for: **`/health`**

3. Edit **`application.properties`** to customize **`/info`**

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Spring Boot Actuator - Security

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What about Security?

- You may **NOT** want to expose all of this information


```
{
  "contexts": {
    "application": {
      "beans": {
        "endpointCachingOperationInvokerAdvisor": {
          "aliases": [],
          "scope": "singleton",
          "type": "org.springframework.boot.actuate.endpoint.invoker.cache.Cach
          "resource": "class path resource [org/springframework/boot/actuate/au
          "dependencies": [
            "environment"
          ]
        },
        "defaultServletHandlerMapping": {
          "aliases": [],
          "scope": "singleton",
          "type": "org.springframework.web.servlet.HandlerMapping",
          "resource": "class path resource [org/springframework/boot/autoconfig
          "dependencies": []
        },
        "org.springframework.boot.autoconfigure.web.servlet.WebMvcAutoConfigura
          "aliases": [],
          "scope": "singleton",
          "type":
```


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What about Security?

- You may **NOT** want to expose all of this information
- Add Spring Security to project and endpoints are secured :-)

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

/health
is still available
You can disable it
if you want

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Secured Endpoints

- Now when you access: **`/actuator/beans`**
- Spring Security will prompt for login

Default user name: **`user`**

Check console logs for password

```
11-02 21:05:57.074  INFO 24986 --- [          main] .s.s.UserDetailsSe
Using generated security password: 78fd68a6-c190-421d-934b-df7852fc7dc2
```


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Spring Security configuration

- You can override default user name and generated password

File: src/main/resources/application.properties

```
spring.security.user.name=scott
spring.security.user.password=tiger
```


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Customizing Spring Security

- You can customize Spring Security for Spring Boot Actuator
  - Use a database for roles, encrypted passwords etc …
- We will cover details of Spring Security later in the course

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Excluding Endpoints

- To exclude **`/health`**

File: src/main/resources/application.properties

```
# Exclude individual endpoints with a comma-delimited list
#
management.endpoints.web.exposure.exclude=health
```


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Spring Boot Actuator Documentation

For more details

www.luv2code.com/actuator-docs

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Development Process

Step-By-Step

1. Edit **`pom.xml`** and add **`spring-boot-starter-security`**

2. Verify security on actuator endpoints for: **`/beans`** etc

3. Disable endpoints for **`/health`** and **`/info`**

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Spring Boot: Run from Command-Line

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Running from the Command-Line

- During development we spend most of our time in the IDE

- However, we may want to run our Spring Boot app outside of the IDE

- One approach is running from the command-line

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Running from the Command-Line

- When running from the command-line
  - No need to have IDE open/running

- Since we using Spring Boot, the server is embedded in our JAR file
  - No need to have separate server installed/running

- Spring Boot apps are self-contained

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Running from the Command-Line

- Spring Boot apps are self-contained

mycoolapp.jar

Self-contained unit
Nothing else to install

JAR file
includes your application code
AND
includes the server

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Running from the Command-Line

- Two options for running the app

- Option 1: Use **`java -jar`**

- Option 2: Use Spring Boot Maven plugin
  - **`mvnw spring-boot:run`**

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Option 1: Use `java -jar`

mycoolapp.jar

```
> java -jar mycoolapp.jar
```

Name of our JAR file

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Option 2: Use Spring Boot Maven plugin

- **`mvnw`** allows you to run a Maven project
  - No need to have Maven installed or present on your path
  - If correct version of Maven is NOT found on your computer
    - **Automatically downloads** correct ve
      and runs Maven
- Two files are provided
  - **`mvnw.cmd`** for MS Windows
  - **`mvnw.sh`** for Linux/Mac

```
> mvnw clean compile test
```

```
$ ./mvnw clean compile test
```


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Maven Wrapper files

- If you already have Maven installed previously
  - Then you can ignore/delete the **`mvnw`** files

- Just use Maven as you normally would

```
$ mvn clean compile test
```

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Option 2: Use Spring Boot Maven plugin

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

To package executable jar or war archive

Can also easily run the app

```
$ ./mvnw package

$ ./mvnw spring-boot:run
```

Can also just use:

mvn package
mvn spring-boot:run

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Development Process

Step-By-Step

1. Exit the IDE

2. Package the app using **`mvnw package`**

3. Run app using **`java -jar`**

4. Run app using Spring Boot Maven plugin, **`mvnw spring-boot:run`**

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Spring Boot - Custom Application Properties

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Problem

- You need for your app to be configurable … no hard-coding of values
- You need to read app configuration from a properties file

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Solution: Application Properties file

- By default, Spring Boot reads information from a standard properties file
  - Located at: **`src/main/resources/application.properties`**

Standard Spring Boot file name

- You can define ANY custom properties in this file
- Your Spring Boot app can access properties using **`@Value`**

No additional coding or configuration required

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Development Process

Step-By-Step

1. Define custom properties in **`application.properties`**

2. Inject properties into Spring Boot application using **`@Value`**

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Step 1: Define custom application properties

File: src/main/resources/application.properties

```
#
# Define custom properties
#
coach.name=Mickey Mouse
team.name=The Mouse Club
```

You can give ANY custom property names

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Step 2: Inject Properties into Spring Boot app

No additional coding or configuration required

```
@RestController
public class FunRestController {

  // inject properties for: coach.name and team.name

  @Value("${coach.name}")
  private String coachName;

  @Value("${team.name}")
  private String teamName;

  …
}
```

File: src/main/resources/application.properties

```
#
# Define custom properties
#
coach.name=Mickey Mouse
team.name=The Mouse Club
```


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Spring Boot Properties

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Spring Boot Properties

- Spring Boot can be configured in the **`application.properties`** file
- Server port, context path, actuator, security etc …
- Spring Boot has 1,000+ properties … wowzers!

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Spring Boot Properties

List of Common Properties

www.luv2code.com/spring-boot-props

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Spring Boot Properties

- Don't let the 1,000+ properties overwhelm you
- The properties are roughly grouped into the following categories

Core	Web	Security	Data
Actuator	Integration	DevTools	Testing

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Spring Boot Properties

We'll review some of the properties …

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Core Properties

Core

File: src/main/resources/application.properties

```
# Log levels severity mapping
logging.level.org.springframework=DEBUG
logging.level.org.hibernate=TRACE
logging.level.com.luv2code=INFO

# Log file name
logging.file.name=my-crazy-stuff.log
logging.file.path=c:/myapps/demo
...
```

Logging Levels

TRACE
DEBUG
INFO
WARN
ERROR
FATAL
OFF

Spring Boot Logging
www.luv2code.com/spring-boot-logging

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Web Properties

Web

http://localhost:7070/my-silly-app/fortune

File: src/main/resources/application.properties

```
# HTTP server port
server.port=7070

# Context path of the application
server.servlet.context-path=/my-silly-app

# Default HTTP session time out
server.servlet.session.timeout=15m
...
```

15 minutes

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Actuator Properties

Actuator

File: src/main/resources/application.properties

```
# Endpoints to include by name or wildcard
management.endpoints.web.exposure.include=*

# Endpoints to exclude by name or wildcard
management.endpoints.web.exposure.exclude=beans,mapping

# Base path for actuator endpoints
management.endpoints.web.base-path=/actuator
...
```

http://localhost:7070/actuator/health

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Security Properties

Security

File: src/main/resources/application.properties

```
# Default user name
spring.security.user.name=admin

# Password for default user
spring.security.user.password=topsecret
...
```


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Data Properties

Data

File: src/main/resources/application.properties

```
# JDBC URL of the database
spring.datasource.url=jdbc:mysql://localhost:3306/ecommerce

# Login username of the database
spring.datasource.username=scott

# Login password of the database
spring.datasource.password=tiger
...
```

More on this
in later videos

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Spring Boot Properties

List of Common Properties

www.luv2code.com/spring-boot-props

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Development Process

Step-By-Step

1. Configure the server port

2. Configure the application context path

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