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Spring Boot

Agenda

1. Challenges building non-Boot applications
2. What is Spring Boot?
3. Capabilities

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1. Challenges building non-Boot applications
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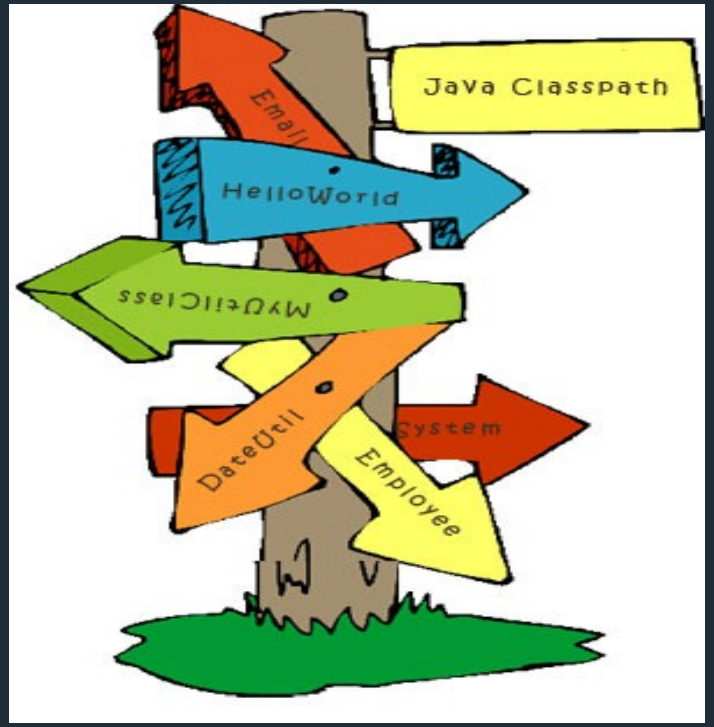
Classpath Hell

- A Jar is missing
- There is one Jar too many
- A class is not visible where it should be



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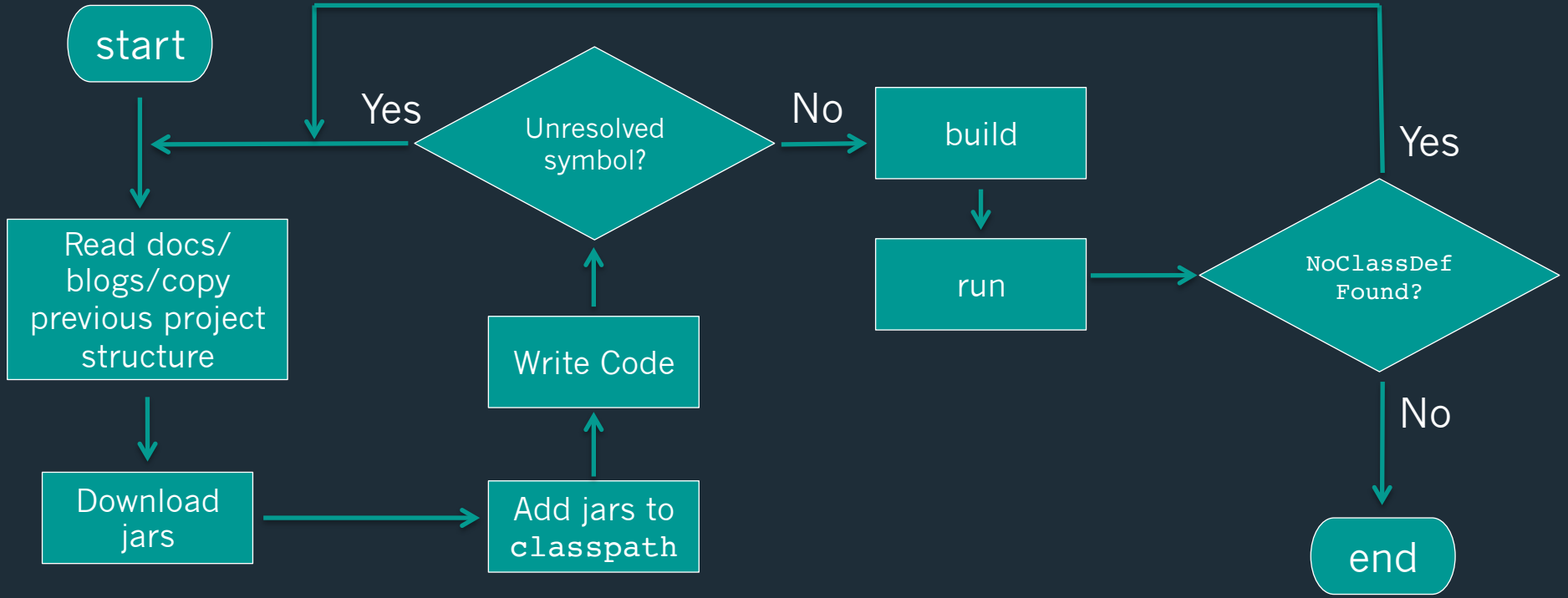
Resolving `Classpath` Hell



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Complex Application Server Setup

Setup

1. Perform setup operations as "`root`"
2. Update `/etc/hosts` with entries for "`localhost`"
3. Create a new group (`oinstall`) and user (`oracle`)
4. Create directories in which Oracle will be installed
5. Add `ORACLE_BASE`, `ORACLE_HOME`, `MW_HOME`, `WLS_HOME`, `WL_HOME`, `DOMAIN_BASE`, `DOMAIN_HOME`, `JAVA_HOME` to `.bash_profile`

Installation

6. Download the installer
7. Run the installer as "`oracle`" user
8. Choose Inventory Directory and Operating System Group
9. Choose `MIDDLEWARE_HOME`
10. Install

Configuration

11. Choose a Domain Location
12. Create a Domain using product templates
13. Provide administrator credentials
14. Choose JDK
15. Configure Admin Server
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Post Installation

19. Start `WebLogic` server
20. Manage and monitor through an administrator console

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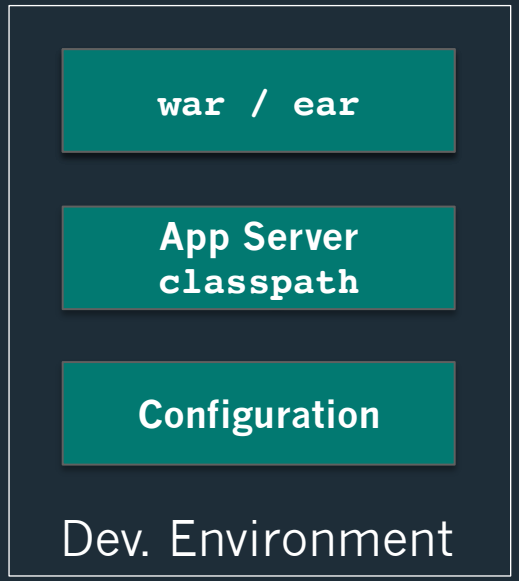
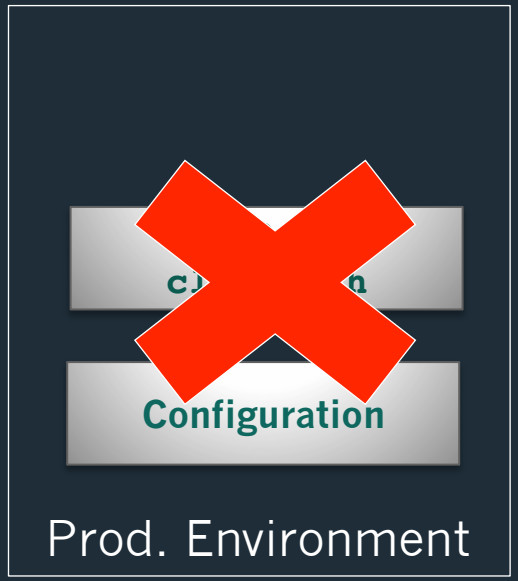
Environment Drift

Standard `war/ear` packaging causes drift across environments





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Boilerplate code

Every application that accesses a relational database with `JDBC` needs to configure a `JdbcTemplate` and a `DataSource`

```
@Bean
public JdbcTemplate jdbcTemplate(
        DataSource dataSource) {
    return new JdbcTemplate(dataSource);
}
```

```
@Bean
public DataSource dataSource() {
    return new EmbeddedDatabaseBuilder()
            .setType(EmbeddedDatabaseType.H2)
            .addScripts("schema.sql", "data.sql")
            .build();
}
```

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Boilerplate code

To get a db connection

- Set Driver
- Set Connection URL
- Set Username
- Set Password
- Catch Exceptions

```
public static Connection getConnection() {
    if (dbConnection != null) {
        return dbConnection;
    } else {
        try {
            InputStream inputStream =
                    DbUtil.class.getClassLoader().
                    getResourceAsStream("db.properties");
            Properties properties = new Properties();
            if (properties != null) {
                properties.load(inputStream);

                String dbDriver = properties.getProperty("dbDriver");
                String connectionUrl = properties.getProperty("connectionUrl");
                String userName = properties.getProperty("userName");
                String password = properties.getProperty("password");

                Class.forName(dbDriver).newInstance();
                dbConnection = DriverManager.
                        getConnection(connectionUrl, userName, password);
            }
        } catch (Exception e) {
            e.printStackTrace();
        }
        return dbConnection;
    }
}
```

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Boilerplate code

For CRUD Operations

- Prepare Statement
- Set Parameters
- Execute Statement
- Catch Exceptions

```
public void save(String userName, String password, String firstName,
        String lastName, String dateOfBirth, String emailAddress) {
    try {
        PreparedStatement prepStatement = dbConnection.prepareStatement(
                "insert into student(userName, password, " +
        "firstName, lastName, dateOfBirth, emailAddress) " +
                        "values (?, ?, ?, ?, ?, ?)");
        prepStatement.setString(1, userName);
        prepStatement.setString(2, password);
        prepStatement.setString(3, firstName);
        prepStatement.setString(4, lastName);
        prepStatement.setDate(5, new java.sql.Date(
                new SimpleDateFormat("MM/dd/yyyy").
                parse(dateOfBirth.substring(0, 10)).getTime()));
        prepStatement.setString(6, emailAddress);

        prepStatement.executeUpdate();
    } catch (SQLException e) {
        e.printStackTrace();
    } catch (ParseException e) {
        e.printStackTrace();
    }
}
```

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Debugging

Scouring log files

```
[2011-02-10 14:14:40,013][?] INFO:server:database user - openpg
[2011-02-10 14:14:40,013][?] INFO:server:initialising distributed
objects services
[2011-02-10 14:14:45,200][?] INFO:server:OpenERP version - 6.0.1
[2011-02-10 14:14:45,210][?] INFO:server:addons_path - C:\Program
Files\OpenERP 6.0\Server\addons
[2011-02-10 14:14:45,210][?] INFO:server:database hostname - localhost
[2011-02-10 14:14:45,210][?] INFO:server:database port - 5432
[2011-02-10 14:14:45,210][?] INFO:server:database user - openpg
[2011-02-10 14:14:45,210][?] INFO:server:initialising distributed
objects services
[2011-02-10 14:14:46,361][?] INFO:web-services:starting HTTP service at
0.0.0.0 port 8069
[2011-02-10 14:14:46,371][?] INFO:web-services:starting HTTPS service
at 0.0.0.0 port 8071
[2011-02-10 14:14:46,371][?] INFO:web-services:Registered XML-RPC over
HTTP
```

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Agenda

1. Challenges building non-Boot applications
2. What is Spring Boot?
3. Capabilities

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What is Spring Boot?

- An opinionated runtime for Spring Projects
- Supports different project types, like Web and Batch
- Handles most low-level, predictable setup for you

- It is not:
  - A code generator
  - An IDE plugin

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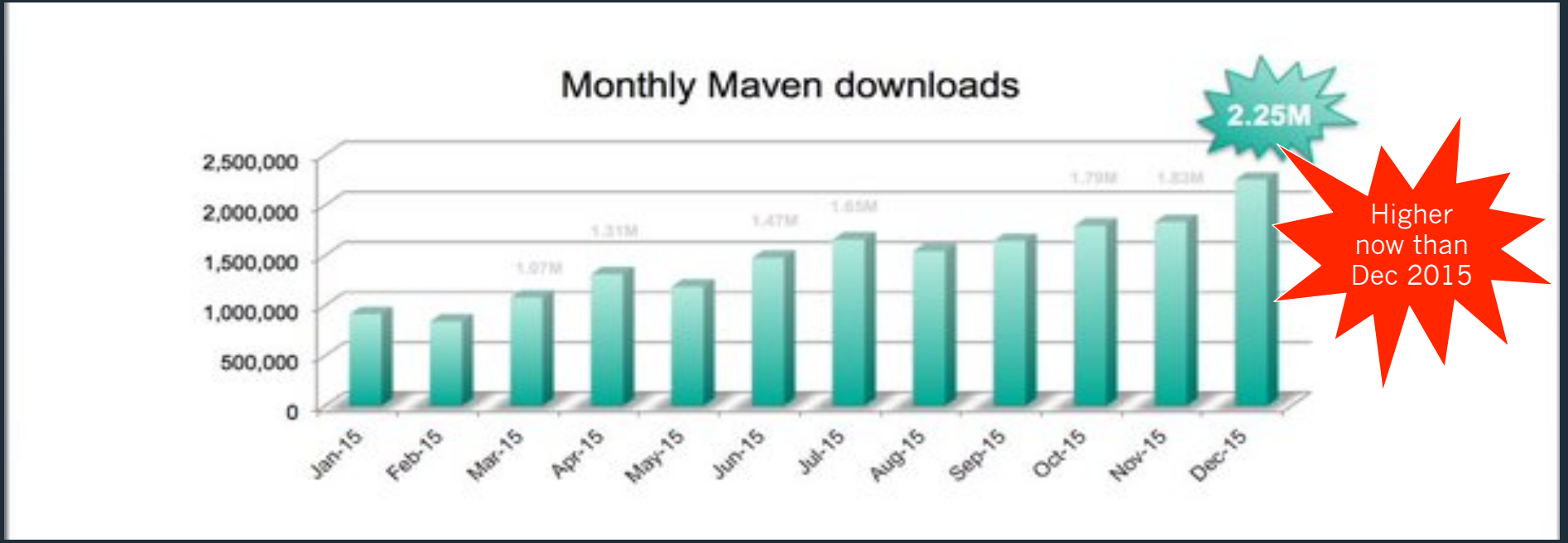
Spring Boot Adoption



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Capabilities

- Quick start project generation
- Automatic project dependency management
- Configuration drift prevention
- Conditional configuration

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- Developer Productivity Tooling
- Auto-configuration
- Monitoring and management endpoints
- Microservices-friendliness

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Spring Initializr

(Quick start project generation)

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Spring Initializr

- Generates a Spring Boot project structure
- Provides a Maven/Gradle build specification
- Doesn’t generate application code
- You can customize the Spring Initialzr
  - `https://github.com/spring-io/initializr/`

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- Generates a Spring Boot project structure
- Provides a Maven/Gradle build specification
- Doesn’t generate application code
- You can customize the Spring Initialzr
  - `https://github.com/spring-io/initializr/`

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Spring Initializr has three supported interfaces

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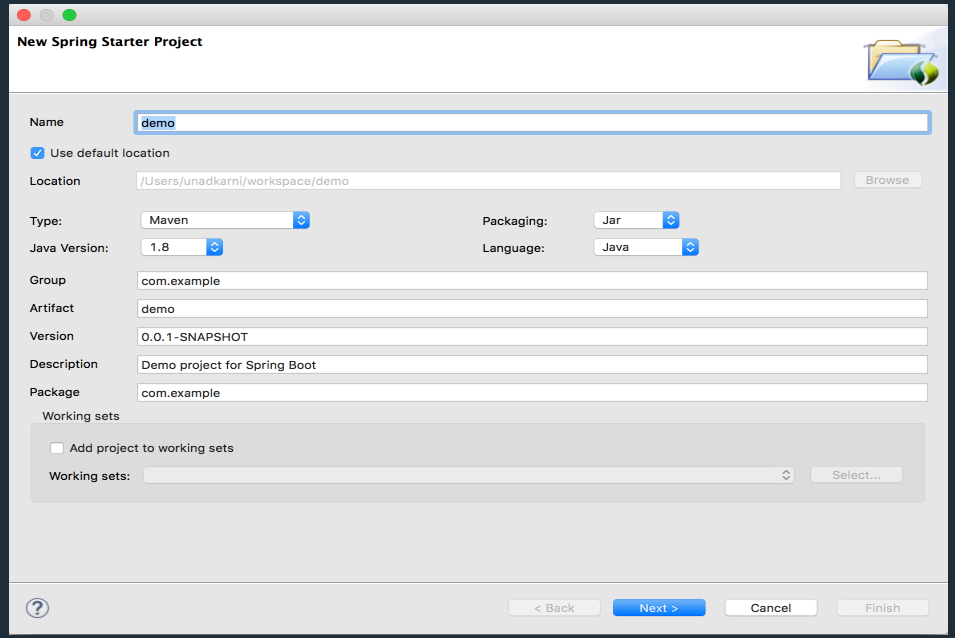
1. IDE

- Eclipse
- Intellij



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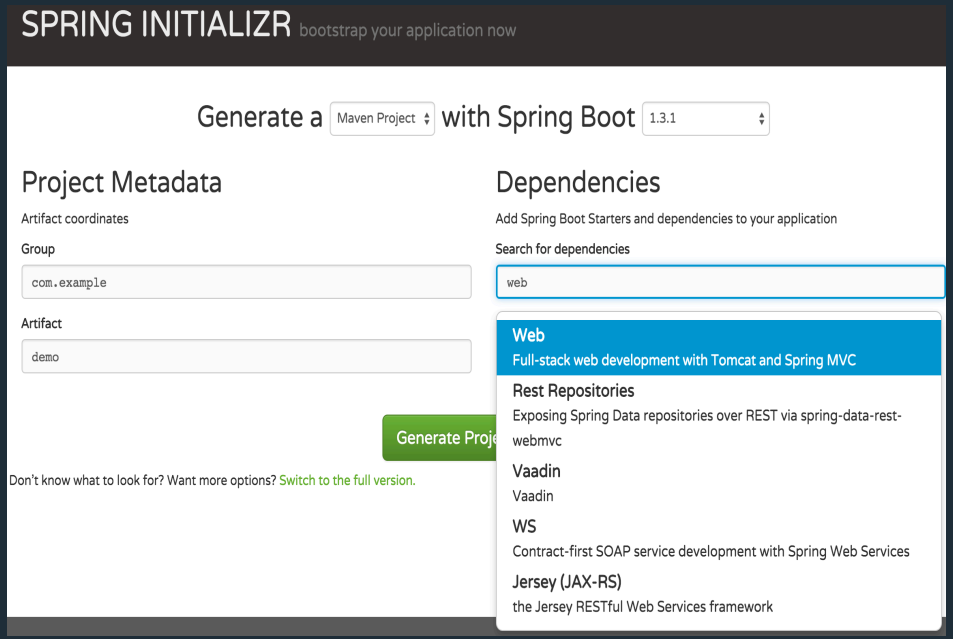
2. Web-based Interface



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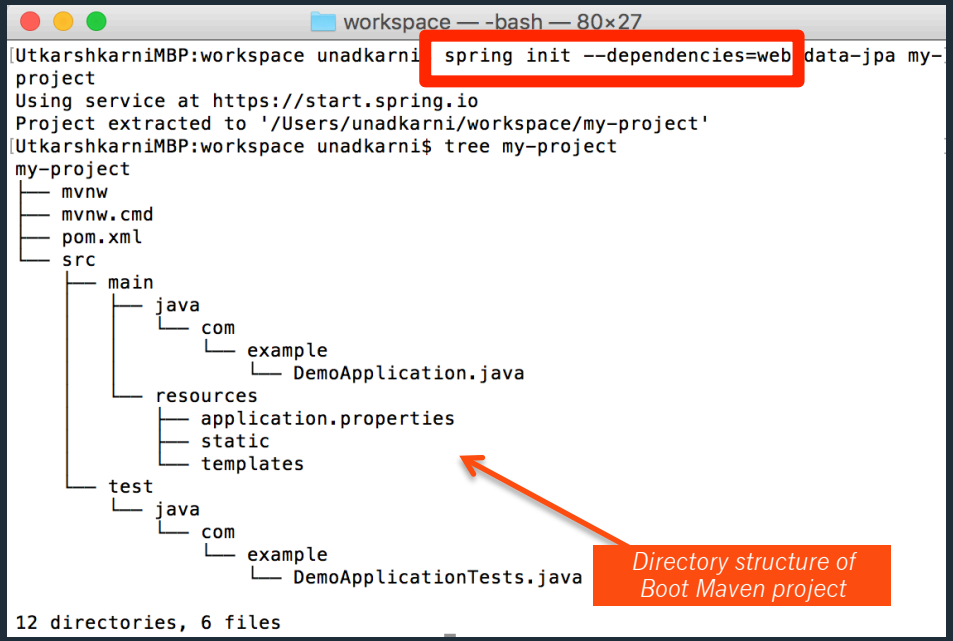
3. Command Line Interface



Spring Boot starters

(Automatic project dependency management)

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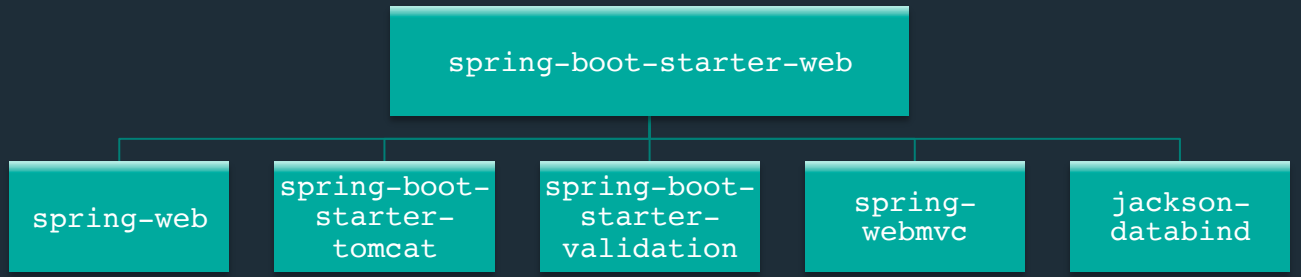
- Are virtual packages deployed to Maven central
- They pull in other dependencies while containing no code of their own



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Project `pom.xml`

- Set parent of your `pom.xml` as `spring-boot-starter-parent`
  - Inherit preset version numbers

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
    <modelVersion>4.0.0</modelVersion>

    <groupId>com.example</groupId>
    <artifactId>demo</artifactId>
    <version>0.0.1-SNAPSHOT</version>
    <packaging>jar</packaging>

    <name>demo</name>
    <description>Demo project for Spring Boot</description>

    <parent>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-parent</artifactId>
        <version>1.3.1.RELEASE</version>
        <relativePath/> <!-- lookup parent from repository -->
    </parent>
```

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Starters vs Current Practice

Starter versions determined by version of Spring Boot used.
Dependencies guaranteed to be compatible.

```
<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-data-jpa</artifactId>
    </dependency>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-web</artifactId>
    </dependency>
    <dependency>
        <groupId>com.h2database</groupId>
        <artifactId>h2</artifactId>
        <scope>runtime</scope>
    </dependency>
</dependencies>
```

Concise. Boot pom.xml without version numbers.

Are the version numbers compatible with each other?
Is the list of dependencies complete?

```
<dependencies>
    <dependency>
        <groupId>org.springframework</groupId>
        <artifactId>spring-web</artifactId>
        <version>4.1.6.RELEASE</version>
    </dependency>
    <dependency>
        <groupId>org.springframework.data</groupId>
        <artifactId>spring-data-jpa</artifactId>
        <version>1.9.2.RELEASE</version>
    </dependency>
    <dependency>
        <groupId>org.hibernate</groupId>
        <artifactId>hibernate-entitymanager</artifactId>
        <version>5.0.6.Final</version>
    </dependency>
    <dependency>
        <groupId>com.h2database</groupId>
        <artifactId>h2</artifactId>
        <version>1.4.190</version>
    </dependency>
</dependencies>
```

Verbose. Non-boot pom.xml with version numbers.

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Packaging

(Configuration drift prevention)

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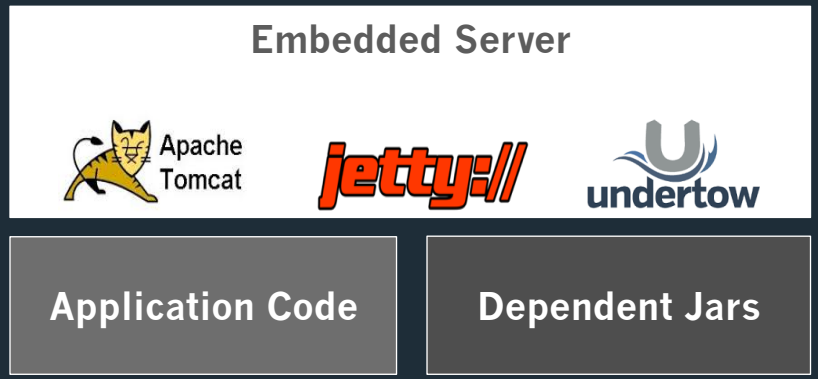
Fat Jars!

Boot's Maven / Gradle plugins produce an executable *"fat jar"*




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

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Benefits

- No installation of application servers
- No setting `classpath`
- Promotes consistency across environments
- Can be started as Unix services using
  - `init.d`
  - `systemd`

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Setup

1. Perform setup operations as "`root`"
2. Update `/etc/hosts` with entries for "`localhost`"
3. Create a new group (`oinstall`) and user (`oracle`)
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The Traditional JEE App Server is Dead!

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Profiles

(Conditional configuration)

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Segregate parts of the application configuration and make it available in certain environments via

- Annotations
- Properties file

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Mark `@Component` or `@Configuration` with `@Profile` to limit when it is loaded.

```
@Configuration
@Profile("development")
public class DevelopmentConfiguration {
    // The @Profile requires that the "development"
    // profile be active at runtime
    // for this configuration to be applied
    // Activate this profile in the properties
    // file with spring.profile.active=development
    // command line with --spring.profiles.active=development
}
```

```
@Configuration
@Profile("production")
public class ProductionConfiguration {
    // The @Profile requires that the "production"
    // profile be active at runtime
    // for this configuration to be applied
    // Activate this profile in the properties
    // file with spring.profile.active=production
    // command line with --spring.profiles.active=production
}
```

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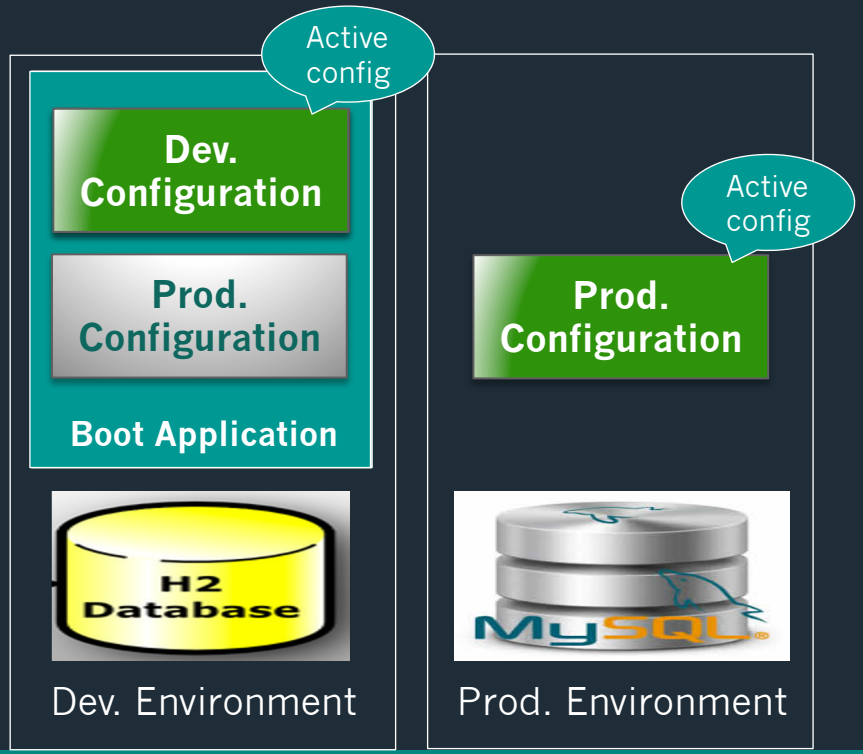

Checkout code from source control

Build an executable jar

Configuration activated based on active profile

Deploy anywhere

No Code Changes

No Configuration Changes

It Just Works!

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Precedence of externalized configuration

1. Command line arguments.
2. Properties from `SPRING_APPLICATION_JSON` (inline JSON embedded in an environment variable or system property)
3. JNDI attributes from `java:comp/env`.
4. Java System properties (`System.getProperties()`).
5. OS environment variables.
6. A `RandomValuePropertySource` that only has properties in `random.*`.
7. Profile-specific application properties outside of your packaged jar (`application-{profile}.properties` and YAML variants)
8. Profile-specific application properties packaged inside your jar (`application-{profile}.properties` and YAML variants)
9. Application properties outside of your packaged jar (`application.properties` and YAML variants).
10. Application properties packaged inside your jar (`application.properties` and YAML variants).
11. `@PropertySource` annotations on your `@Configuration` classes.
12. Default properties (specified using `SpringApplication.setDefaultProperties`).

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Developer Tools

(Developer Productivity Tools)

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- Automatic restart
- *LiveReload*

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

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Automatic Restart

- Restarts a running application when files are changed in the `classpath`

- Excludes static resources from restart considerations
  - `/META-INF/resources`
  - `/resources`
  - `/static`
  - `/public`
  - `/templates`

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LiveReload support

- Install the *LiveReload* plugin into your browser
- Boot starts an embedded *LiveReload* server
- Changes to resources trigger a browser refresh automatically

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Auto-Configuration

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DataSource Configuration

- Use *spring-boot-starter-jdbc* or *spring-boot-starter-data-jpa* and include a JDBC driver on classpath
- Declare propeties

```
spring.datasource.url=jdbc:mysql://localhost/test
spring.datasource.password=password
spring.datasource.driver-class-name=com.mysql.jdbc.Driver
spring.datasource.username=dbuser
```

- That's It!
  - Spring Boot will create a DataSource with properties set
  - Will even use a connection pool if the library is found on the classpath

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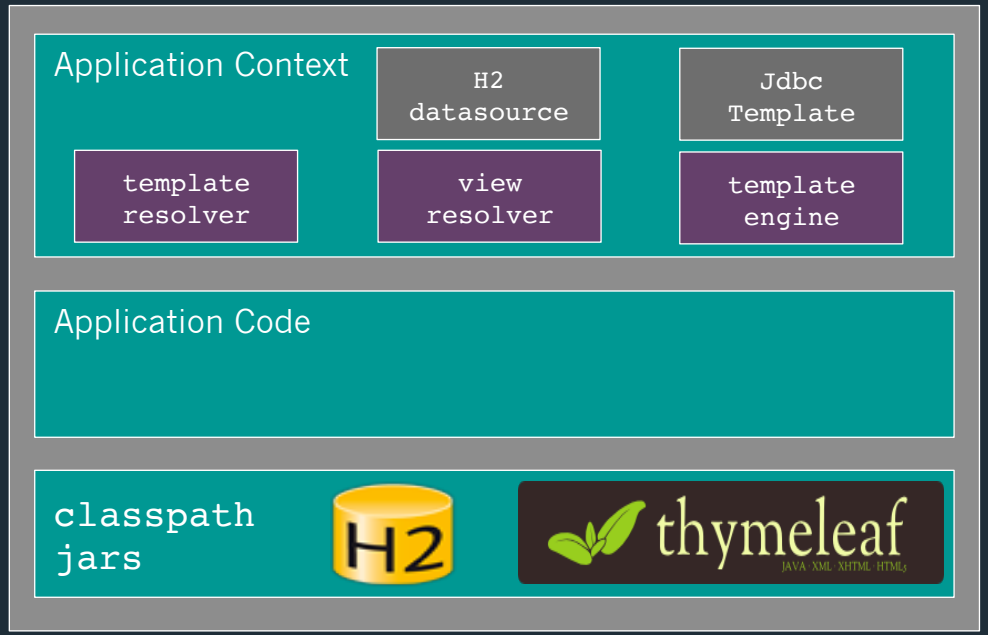
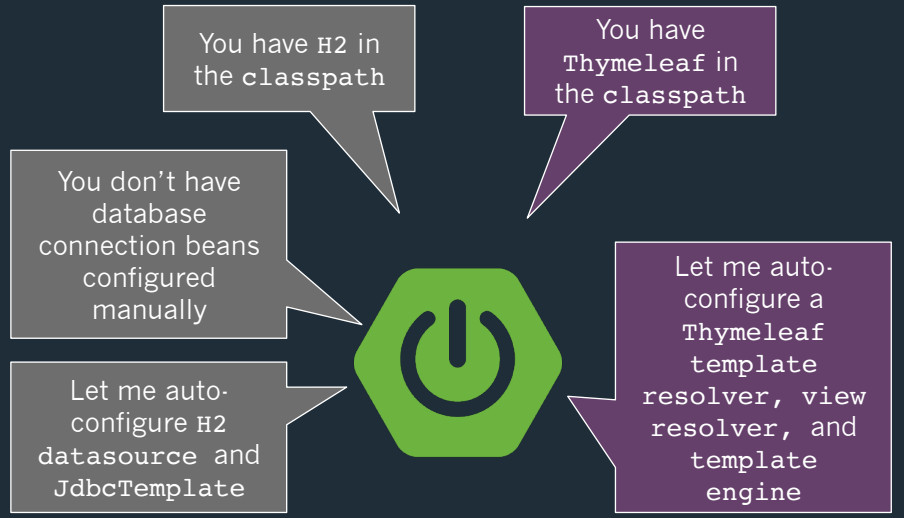
Auto-Configuration

Automatically configures application based on the `classpath`





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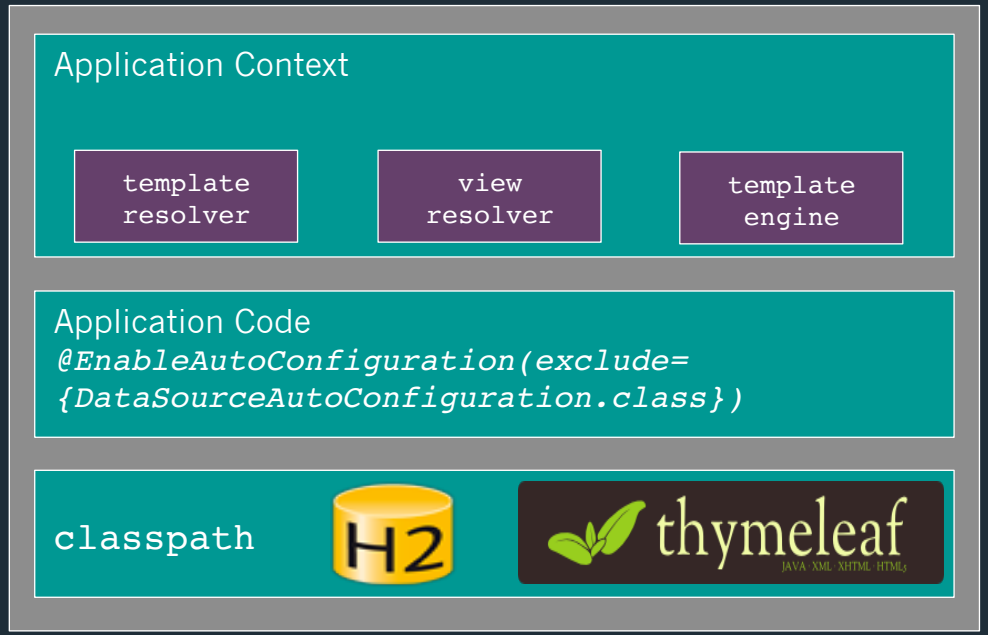
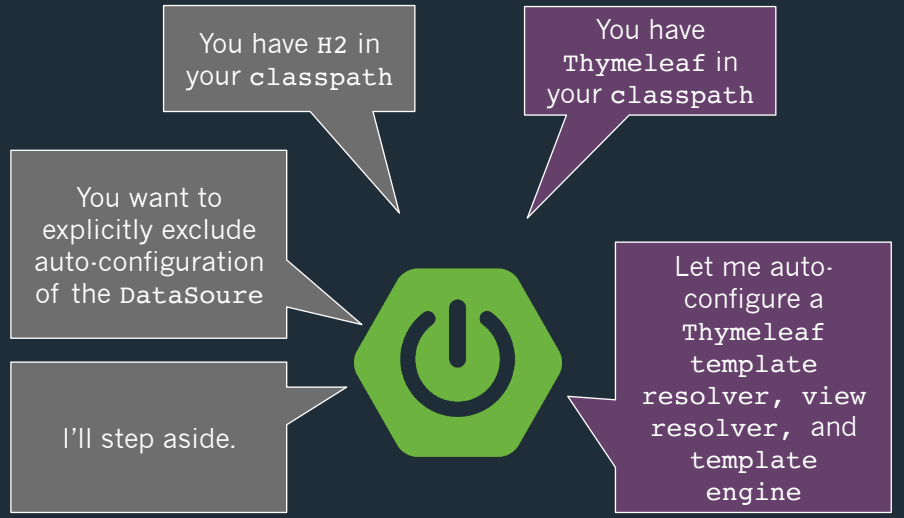
Explicitly exclude Auto-Configuration





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Fine Tuning Auto-Configuration

Over 300 properties to tweak beans in a Boot application via

- Command line arguments
- Environment variables
- `.properties / .yml` file

application.yml

```yaml
# Override server port
server:
  port: 8000

# Turn off caching Thymeleaf templates
spring:
  thymeleaf:
    cache: false

# Set logging levels
# Note: Spring Security package name
# collapsed into a single line
logging:
  level:
    root: WARN
    org.springframework.security: DEBUG

# Configure a Data Source
spring:
  datasource:
    url: jdbc:mysql://localhost/foot
    username: dbuser
    password: dbpass
```

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Actuator

(Monitoring & Management Endpoints)

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Offers production-ready features such as monitoring and metrics to improve operator efficiency

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

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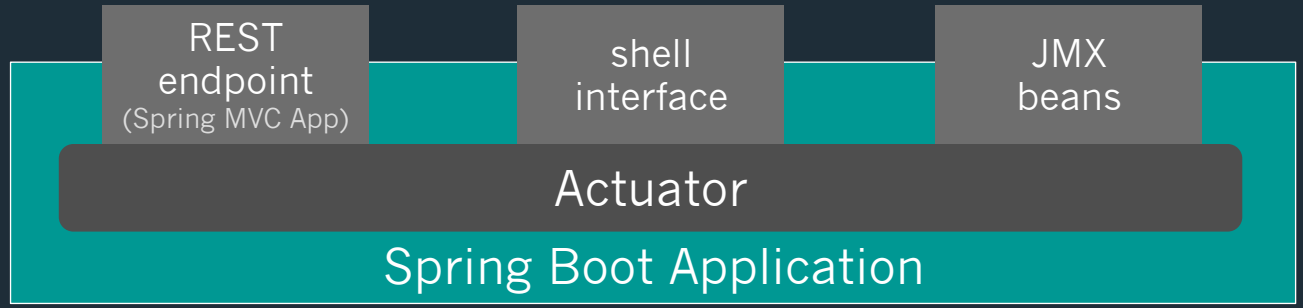
Actuator Services are exposed through

- HTTP endpoints
- shell interface
- JMX Beans



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Types of Actuator Endpoints

Configuration
- `/beans`
- `/autoconfig`
- `/env`
- `/configprops`
- `/controller`

Metrics
- `/metrics`
- `/trace`
- `/dump`

Miscellaneous
- `/shutdown`
- `/info`

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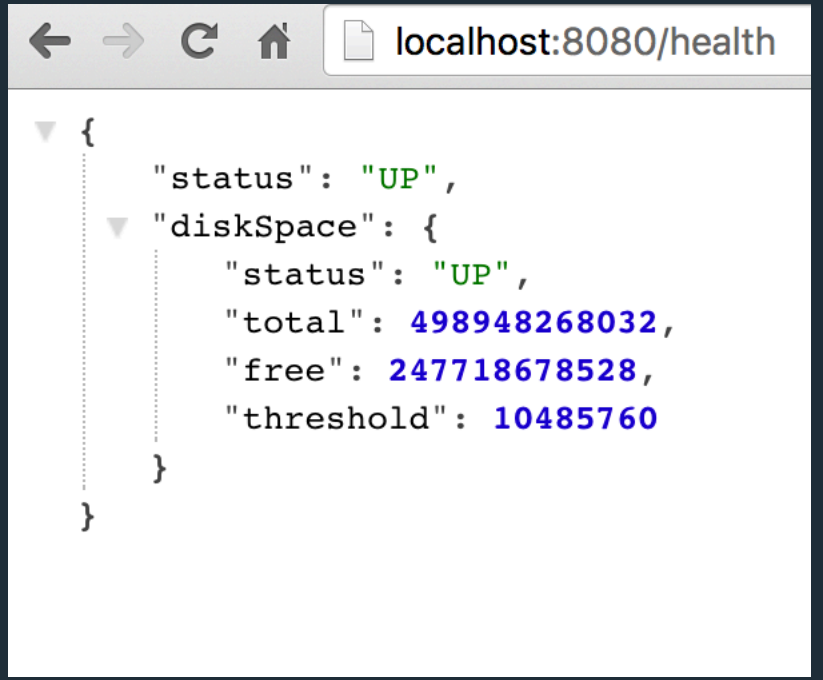
/health

Reports health metrics for the application

- Each check returns a Health object
  - status
    - UP
    - DOWN
    - UNKONWN
    - OUT_OF_SERVICE
- Plugin your own health definitions



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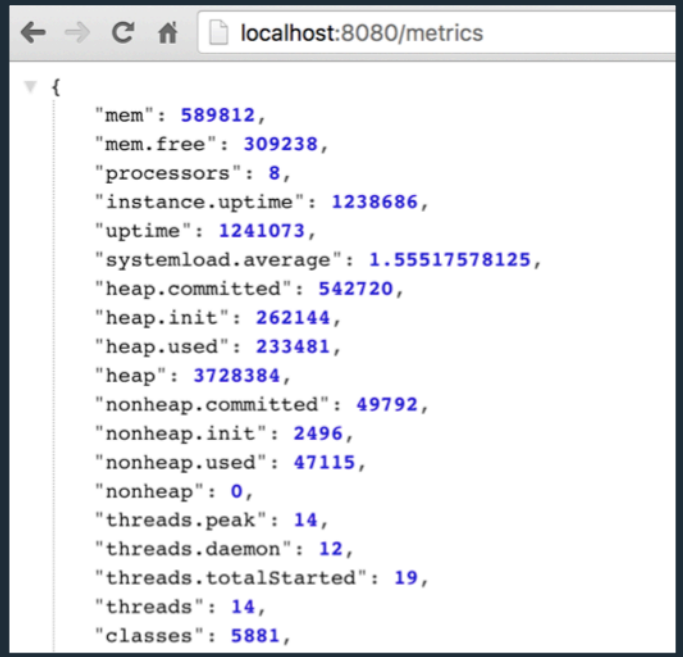
/metrics

Reports application metrics such as

- Memory usage and
- HTTP request counters



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Controlling Log Levels

- Spring Boot can control the log level
  - Just set it in the ***application.properties***
- Works with most logging frameworks
  - Java Util Logging, Logback, Log4J, Log4J2

```
logging.level.org.springframework=DEBUG
logging.level.com.acme.your.code=INFO
```

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Web Application Convinience

- Spring Boot automatically configures Spring MVC DispatcherServlet and @EnableWebMvc defaults
  - When spring-webmvc*.jar on classpath
- Static resources served from the classpath
  - /static, /public, /resources or /META-INF/resources
- Templates server from /templates
  - When Velocity, Freemarker, Thymeleaf, or Groovy on classpath
- Provides default / error mapping
  - Easily overridden

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Microservices

(Microservices-friendliness)

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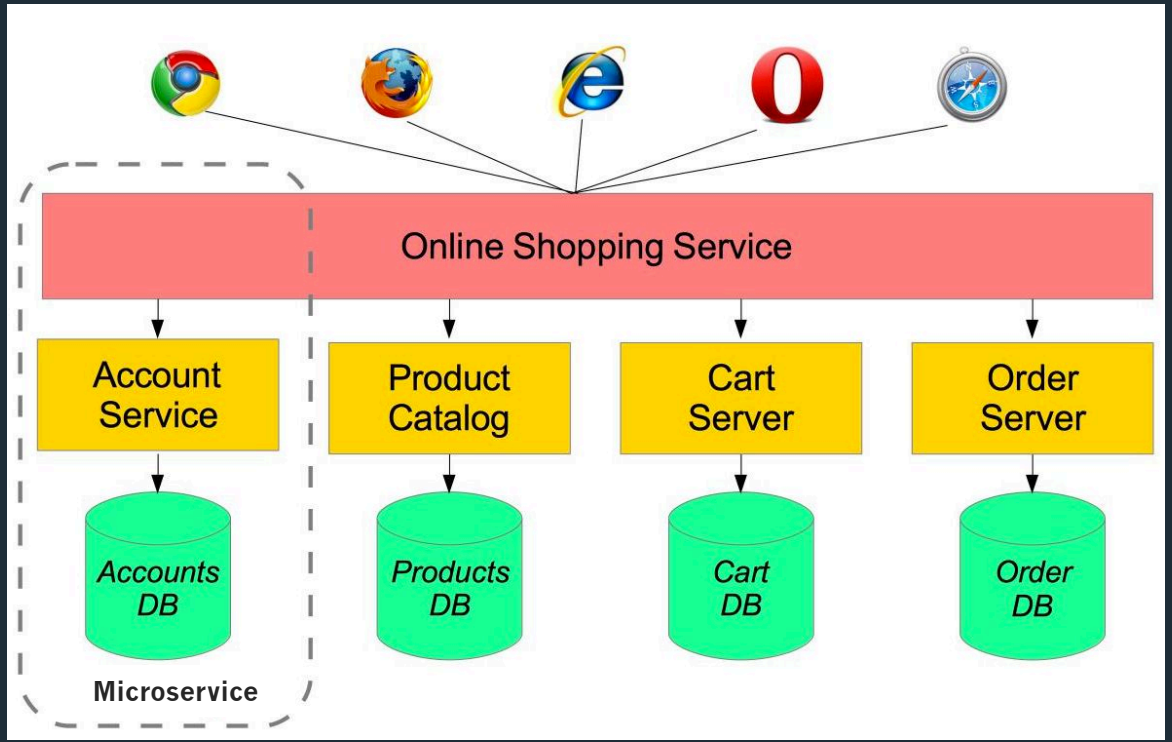
Each microservice is a Spring Boot fat jar



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LAB
AIG