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Spring Boot Primer

Getting Started with Spring Boot to build Cloud Native Apps.

Pivotal

Agenda

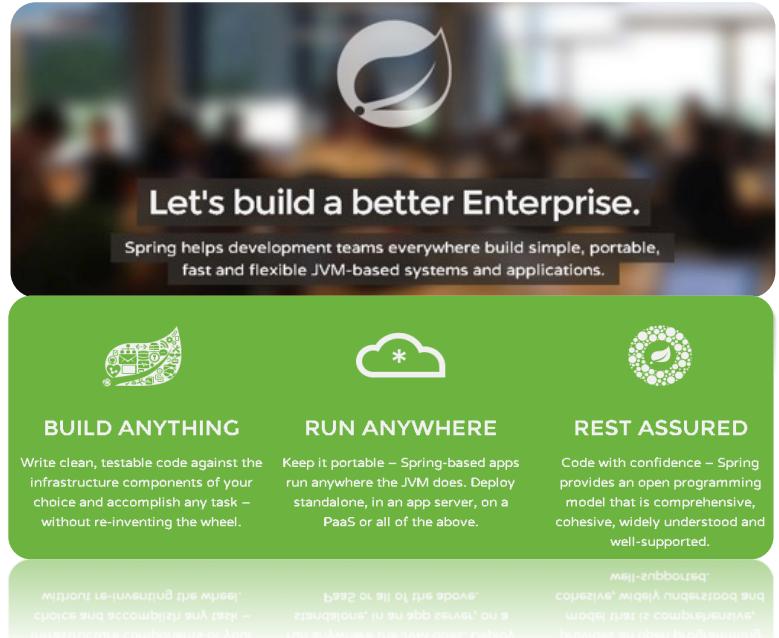
- Challenges building non-Boot applications
- What is Spring Boot?
- Capabilities
- CODE!



What is Spring IO?

the #1 enterprise Java application development framework

- Embodiment of best industry dev practices
- The best of Java OSS, curated & improved
- OSS, Apache 2.0 licensed
- Proven, mature, since 2004
- Well understood and documented
- Millions of downloads
- Used heavily by Netflix and F2000



The screenshot shows the Spring IO homepage. At the top is a dark banner with the text "Let's build a better Enterprise." and a subtext box stating "Spring helps development teams everywhere build simple, portable, fast and flexible JVM-based systems and applications." Below this is a blurred background image of a person working at a computer. The main content area has three green cards. The first card, "BUILD ANYTHING", features a gear icon and text about writing clean, testable code against infrastructure components. The second card, "RUN ANYWHERE", features a cloud icon and text about portability across JVM environments. The third card, "REST ASSURED", features a leaf icon and text about the open programming model. At the bottom, there are several small, overlapping text boxes containing links like "Java 8 API", "Spring Data JPA", "Spring Cloud", "Spring Boot", "Spring Security", and "Spring Integration".

Let's build a better Enterprise.

Spring helps development teams everywhere build simple, portable, fast and flexible JVM-based systems and applications.

BUILD ANYTHING

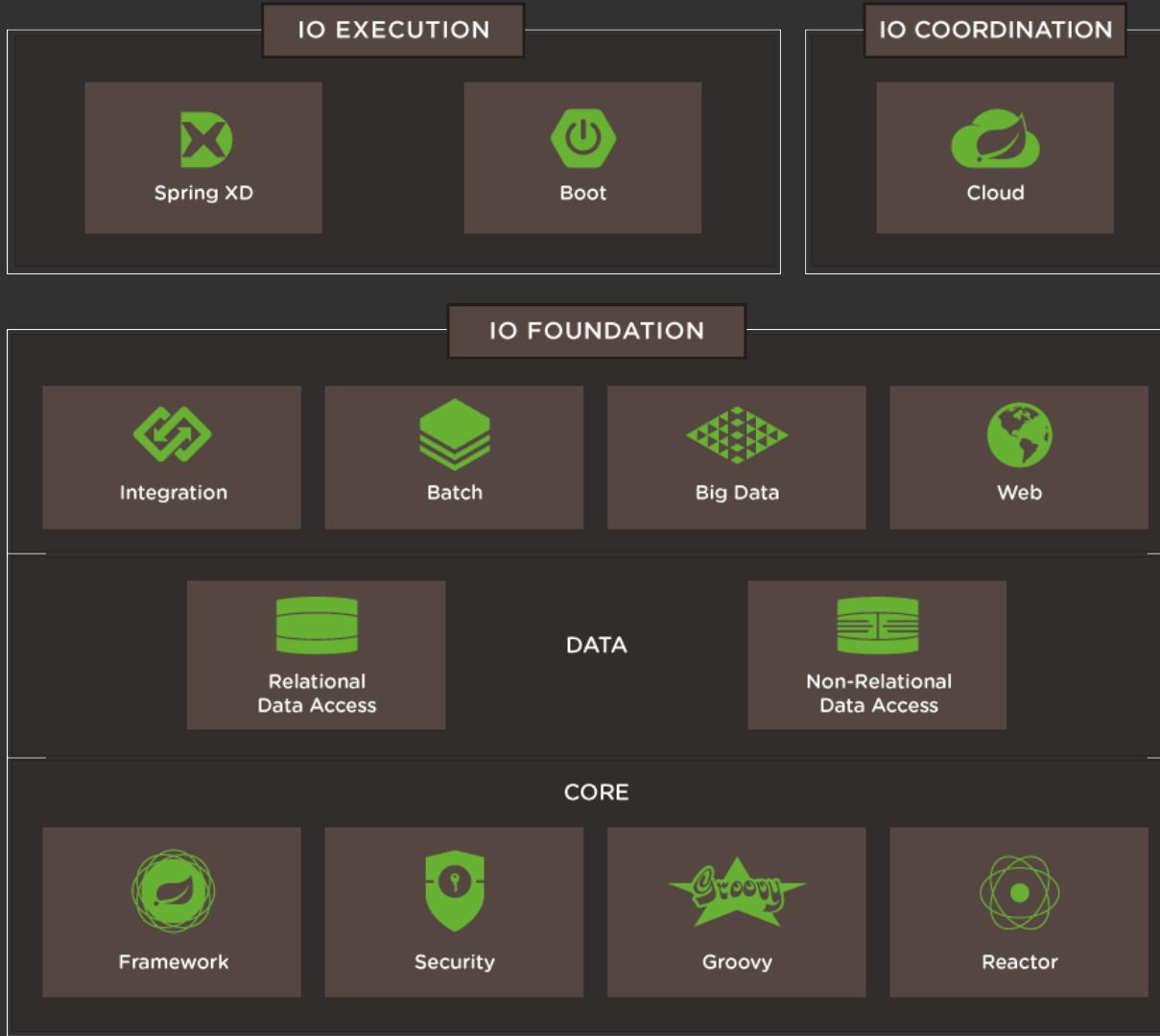
Write clean, testable code against the infrastructure components of your choice and accomplish any task – without re-inventing the wheel.

RUN ANYWHERE

Keep it portable – Spring-based apps run anywhere the JVM does. Deploy standalone, in an app server, on a PaaS or all of the above.

REST ASSURED

Code with confidence – Spring provides an open programming model that is comprehensive, cohesive, widely understood and well-supported.



Challenges writing non-Boot applications

```
<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-context</artifactId>
    <version>4.1.6.RELEASE</version>
</dependency>
<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-aop</artifactId>
    <version>4.1.6.RELEASE</version>
</dependency>
<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-webmvc</artifactId>
    <version>4.1.6.RELEASE</version>
</dependency>
<dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-web</artifactId>
    <version>4.1.6.RELEASE</version>
</dependency>
```

Spring

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns:util="http://www.springframework.org/schema/util"
       xmlns:jee="http://www.springframework.org/schema/jee"
       xmlns:lang="http://www.springframework.org/schema/lang"
       xmlns:aop="http://www.springframework.org/schema/aop"
       xmlns:tx="http://www.springframework.org/schema/tx"
       xmlns:sca="http://xmlns.oracle.com/weblogic/weblogic-sca"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
       xsi:schemaLocation="http://www.springframework.org/schema/beans http://www.springframework.org/schema/beans.xsd">
    <reference
        type="JMSOUT_jcd_Convert_JMS_1.capsprojectfileinbpcallingjcd.jms.adapter.pcbpel.com.oracle.jcd.Convert_JMS_1"
        name="JMSOUT_jcd_Convert_JMS_1" xmlns="http://xmlns.oracle.com/weblogic/weblogic-sca"/>
    <reference
        type="FILEOUT_jcd_Convert_FileClient_1.capsprojectfileinbpcallingjcd.file.adapter.pcbpel.com.oracle.jcd.Convert_FileClient_1"
        name="FILEOUT_jcd_Convert_FileClient_1" xmlns="http://xmlns.oracle.com/weblogic/weblogic-sca"/>
    <service type="urn_stc_egate_jce_jcd_convertwsdl.ExecutePortType"
        name="jcd_Convert" target="ExecutePortType" xmlns="http://xmlns.oracle.com/weblogic/weblogic-sca"/>
    <bean name="ExecutePortType" class="CAPSPProjectFileInBPCallingJCD.jcd_Convert">
        <property name="JMSOUT_jcd_Convert_JMS_1" ref="JMSOUT_jcd_Convert_JMS_1"/>
        <property name="FILEOUT_jcd_Convert_FileClient_1" ref="FILEOUT_jcd_Convert_FileClient_1"/>
        <property name="collabContext" ref="collabCtxBean"/>
        <property name="typeConverter" ref="typeConverterBean"/>
        <property name="logger" ref="loggerBean"/>
        <property name="alerter">
            <null/>
        </property>
    </bean>
    <bean name="collabCtxBean" scope="prototype" class="oracle.integration.platform.blocks.java.jcd.collab.CollaborationContext">
        <constructor-arg type="java.util.Map">
            <map key-type="java.lang.String" value-type="java.lang.String">
                <entry key="CollaborationName" value="jcd_Convert"/>
            </map>
        </constructor-arg>
    </bean>
```

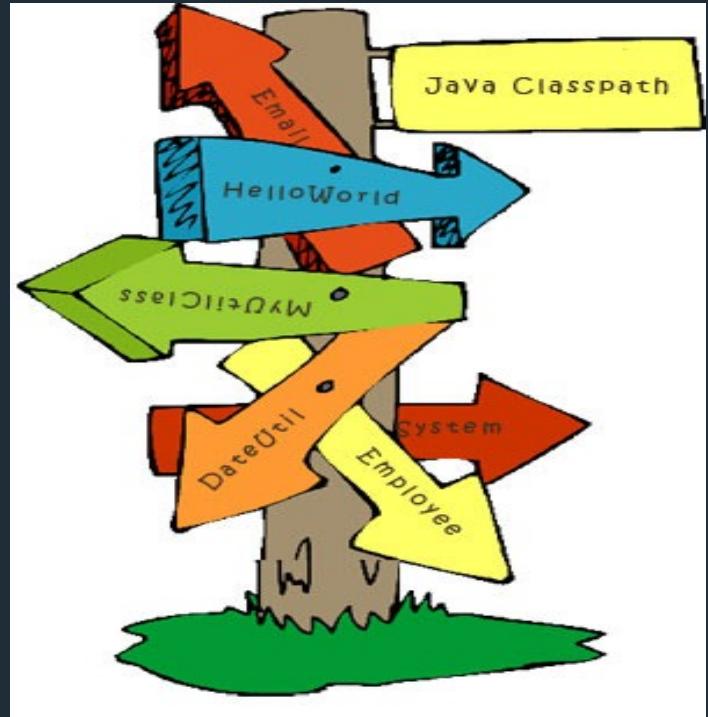
Challenges writing non-Boot applications

Version incompatibility of libraries

```
Exception in thread "main" java.lang.NoClassDefFoundError: javax/transaction/SystemException
  at java.lang.Class.forName0(Native Method)
  at java.lang.Class.forName(Class.java:344)
  at org.jboss.logging.Logger$1.run(Logger.java:2554)
  at java.security.AccessController.doPrivileged(Native Method)
  at org.jboss.logging.Logger.getMessageLogger(Logger.java:2529)
  at org.jboss.logging.Logger.getMessageLogger(Logger.java:2516)
  at org.hibernate.internal.CoreLogging.messageLogger(CoreLogging.java:28)
  at org.hibernate.internal.CoreLogging.messageLogger(CoreLogging.java:24)
  at org.hibernate.cfg.Configuration.<clinit>(Configuration.java:86)
  at com.mycompany.ContactManager.main(ContactManager.java:20)
Caused by: java.lang.ClassNotFoundException: javax.transaction.SystemException
  at java.net.URLClassLoader$1.run(URLClassLoader.java:372)
  at java.net.URLClassLoader$1.run(URLClassLoader.java:361)
  at java.security.AccessController.doPrivileged(Native Method)
  at java.net.URLClassLoader.findClass(URLClassLoader.java:360)
  at java.lang.ClassLoader.loadClass(ClassLoader.java:424)
  at sun.misc.Launcher$AppClassLoader.loadClass(Launcher.java:308)
  at java.lang.ClassLoader.loadClass(ClassLoader.java:357)
  ... 10 more
```

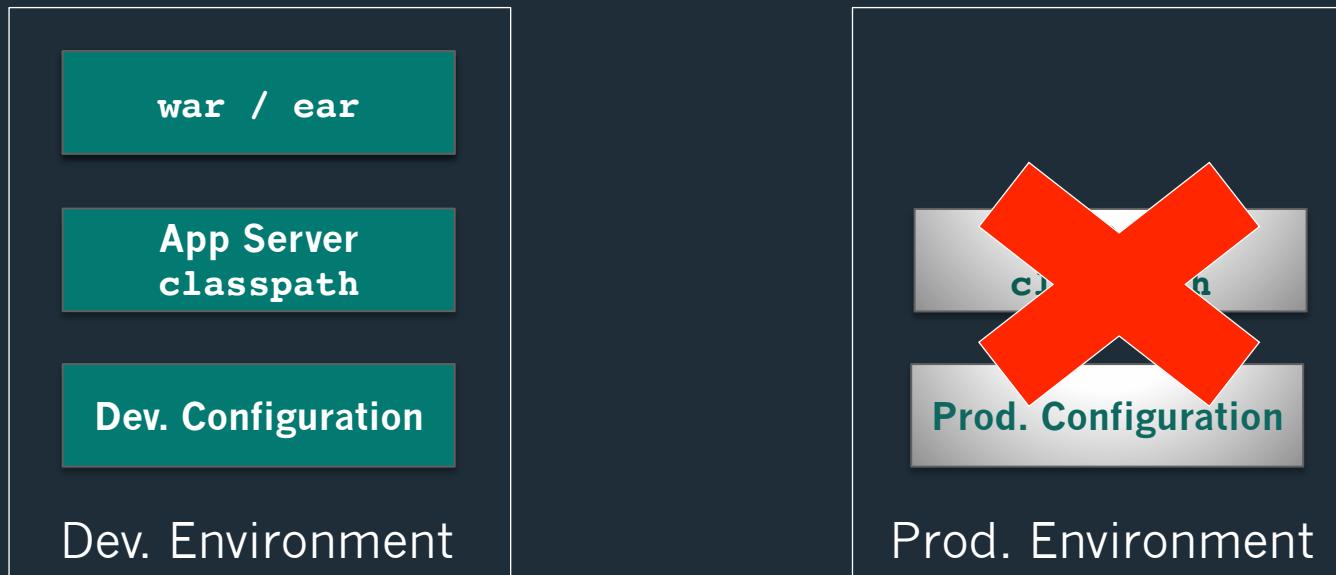
Challenges building non-Boot applications

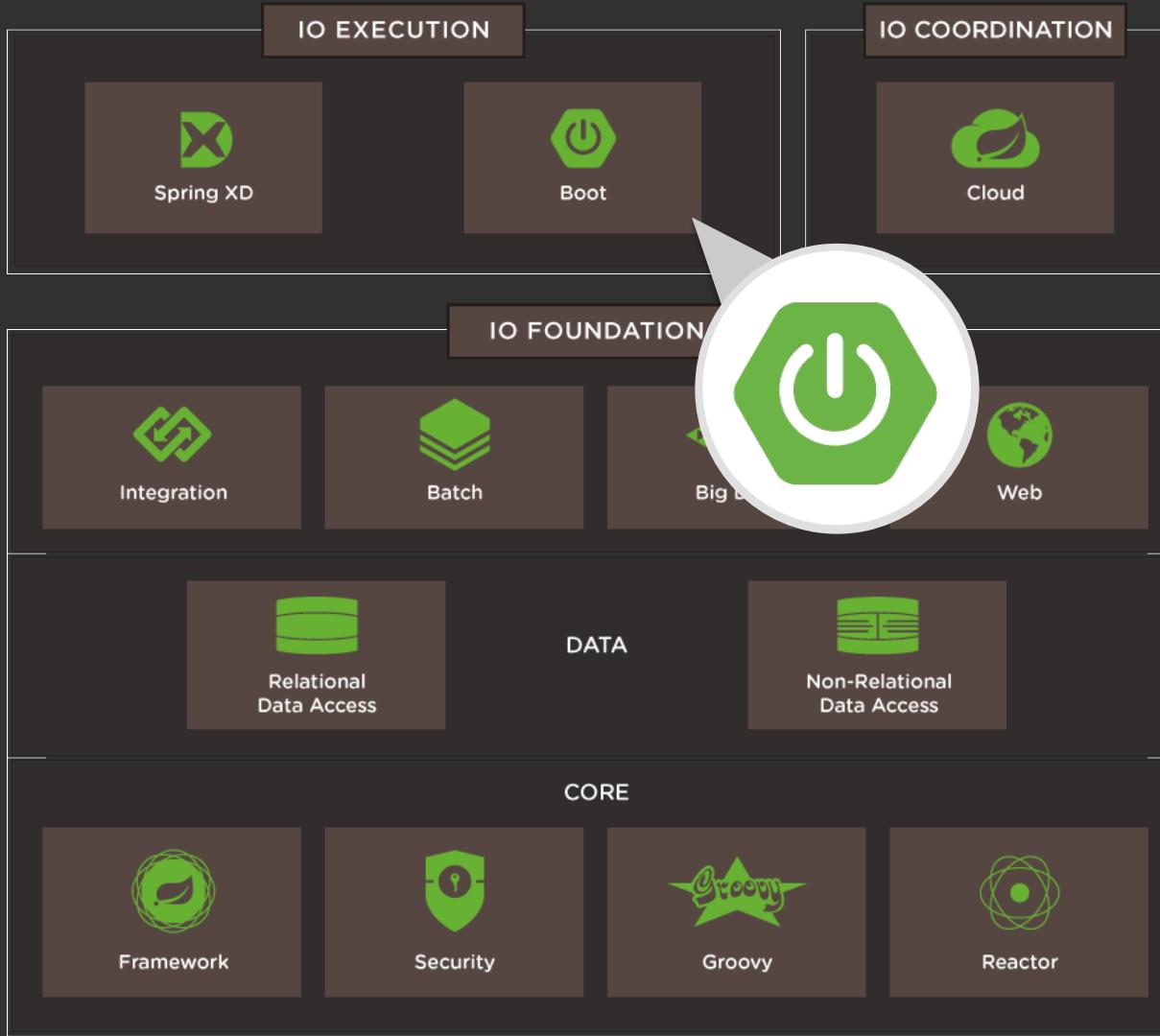
- Classpath errors
 - A Jar is missing
 - There is one Jar too many
 - A class is not visible where it should be



Challenges building non-Boot applications

Standard war/ear packaging causes drift across environments





What is Spring Boot?

An opinionated framework to simplify
bootstrapping and development of new Spring
Applications

Spring Boot



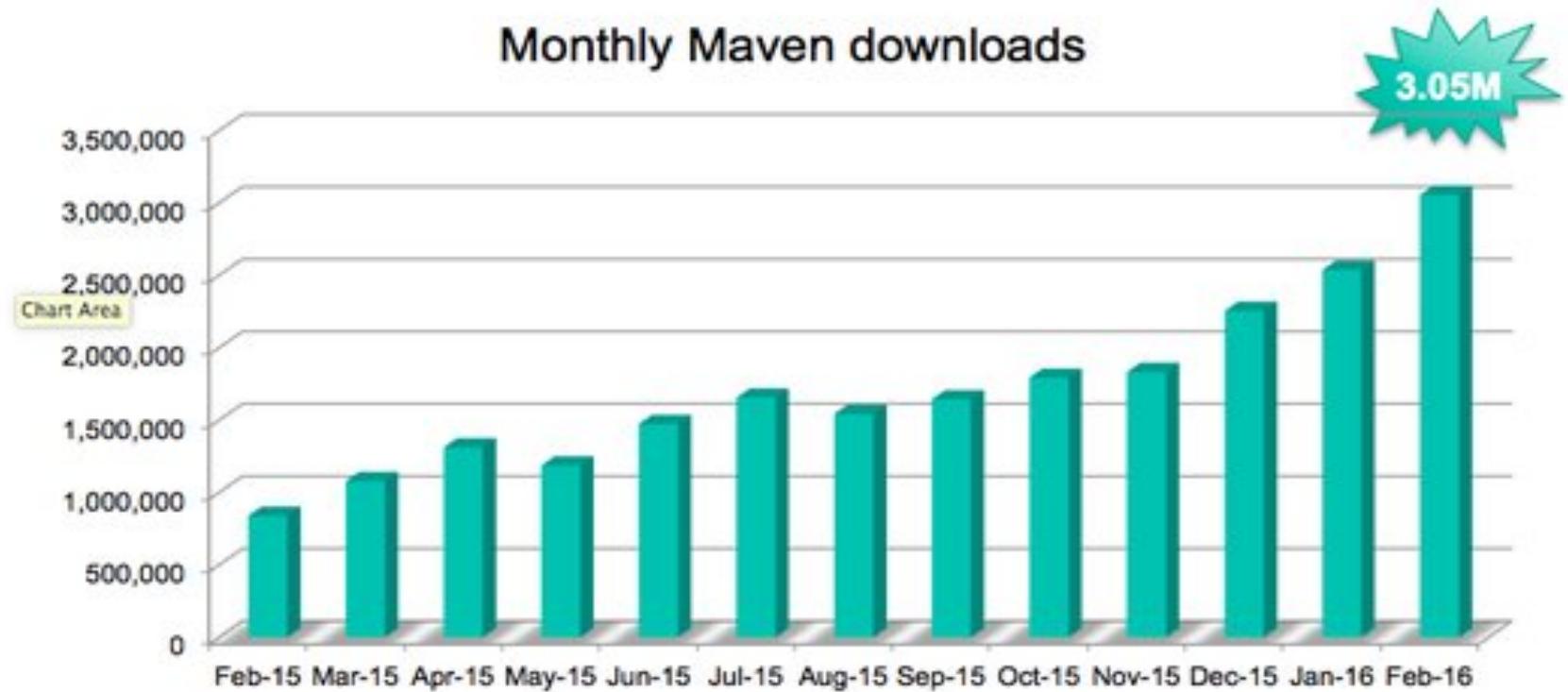
Dynamic language productivity
with maturity of enterprise Java

Cloud Native: Direct support
for Microservices, NetflixOSS
++

Fully automated app server
configuration and deployment

Production ready Ops metrics
out of the box, with a switch

Spring Boot Adoption



Source: oss.sonatype.org

Capabilities

- Provides a consistent and easy way to start a project
- Manages project dependencies
- Packages deployable artifacts prevent configuration drift across environments
- Provides conditional configuration across environments
- Provides tools to improve developer productivity
- Keeps you from writing explicit configuration
- Exposes endpoints to manage and monitor applications in production



D E M O



CF





Generate a Maven Project with Spring Boot 1.3.1

Project Metadata

Artifact coordinates

Group

Artifact

Generate Project

Don't know what to look for? Want more options? [Switch to the full version.](#)

Dependencies

Add Spring Boot Starters and dependencies to your application

Search for dependencies

Web

Full-stack web development with Tomcat and Spring MVC

Rest Repositories

Exposing Spring Data repositories over REST via spring-data-rest-webmvc

Vaadin

Vaadin

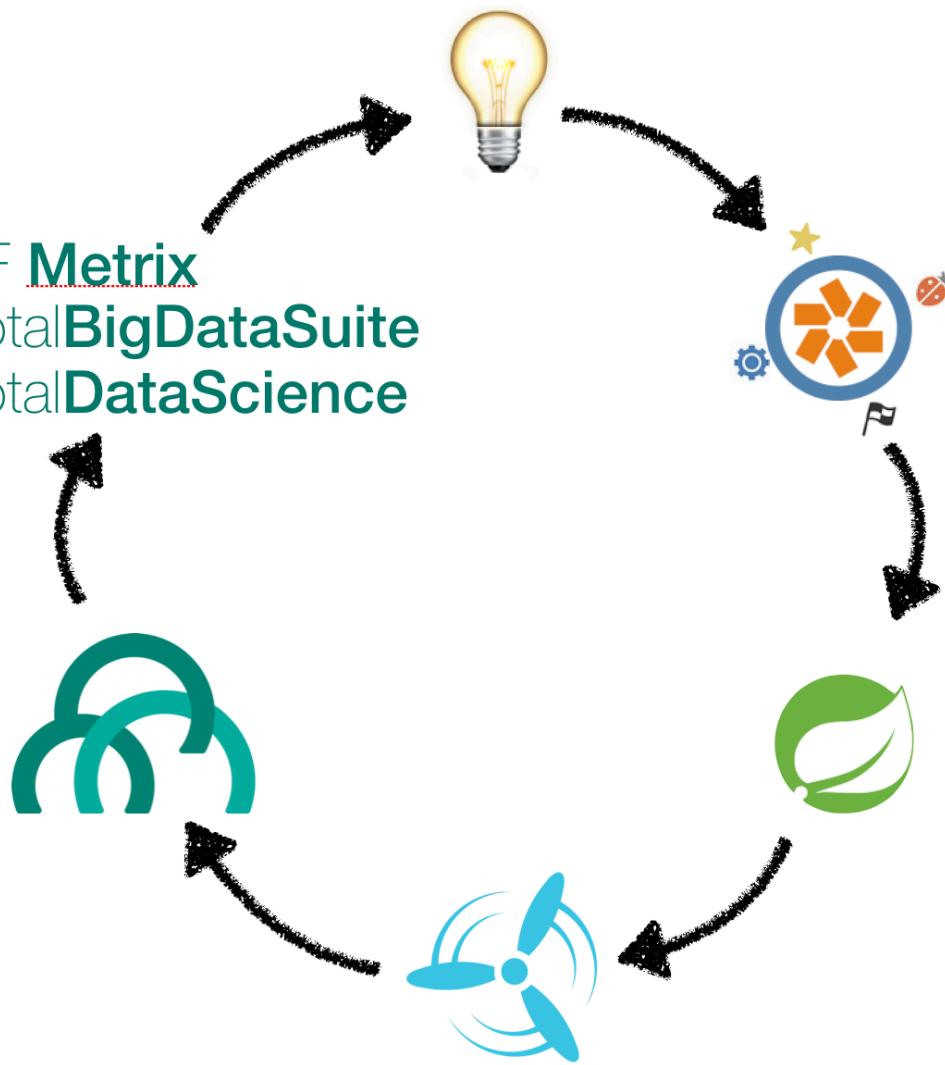
WS

Contract-first SOAP service development with Spring Web Services

Jersey (JAX-RS)

the Jersey RESTful Web Services framework

PCF **Metrix**
Pivotal**BigDataSuite**
Pivotal**DataScience**



Further Reading

- Initializr- <http://start.spring.io>
- Spring.io- <http://spring.io/spring-boot>
- HATEOAS- <http://spring.io/spring-hateoas>
- Spring Data Rest-
<http://spring.io/spring-data-rest>

BACKUP

A teal-colored cloud-shaped graphic containing the letters "CF".

CF

Spring Initializr

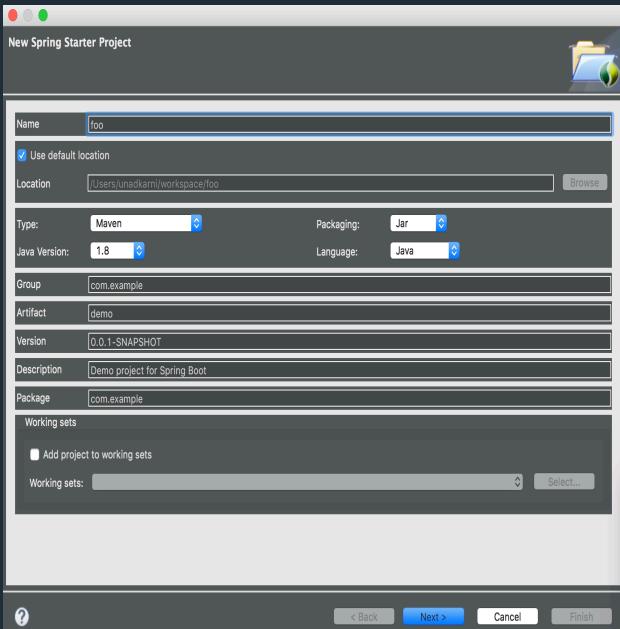
A configurable service to consistently and easily generate a quickstart project

Spring Initializr

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

Supported Interfaces

1. IDE



2. Web-based interface

The screenshot shows the Spring Initializr web interface. It has a header 'SPRING INITIALIZR bootstrap your application now'. Below it, a central area says 'Generate a Maven Project with Spring Boot 1.3.1'. On the left is a 'Project Metadata' section with 'Artifact coordinates' (Group: com.example, Artifact: demo) and 'Dependencies' (Artifact: web). On the right is a 'Dependencies' section with a search bar ('Search for dependencies') and a list of starters ('Add Spring Boot Starters and dependencies to your application'). The 'Web' starter is selected. At the bottom is a 'Generate Project' button. A note at the bottom says 'Don't know what to look for? Want more options? Switch to the full version.'

3. Spring Boot CLI

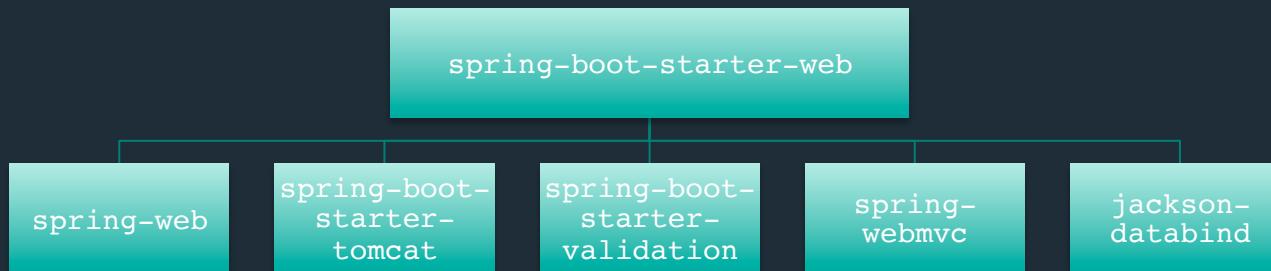
The screenshot shows a terminal window with the following session:

```
UtkarshkarniMBP:workspace unadkarni$ spring init --dependencies=web,data-jpa my-project
Using service at https://start.spring.io
Project extracted to '/Users/unadkarni/workspace/my-project'
UtkarshkarniMBP:workspace unadkarni$ tree my-project
my-project
├── mvnw
├── mvnw.cmd
└── pom.xml
└── src
    ├── main
    │   └── java
    │       └── com
    │           └── example
    │               └── DemoApplication.java
    ├── resources
    │   ├── application.properties
    │   ├── static
    │   └── templates
    └── test
        └── java
            └── com
                └── example
                    └── DemoApplicationTests.java
```

At the bottom, the terminal displays '12 directories, 6 files'.

Spring Boot starters

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



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>
```

Starters vs Current Practice

Starter versions determined by version of Spring Boot used.
No explicit version numbers. 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>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-thymeleaf</artifactId>
  </dependency>
  <dependency>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-test</artifactId>
    <scope>test</scope>
  </dependency>
</dependencies>
```

Concise. Boot pom.xml without version numbers.

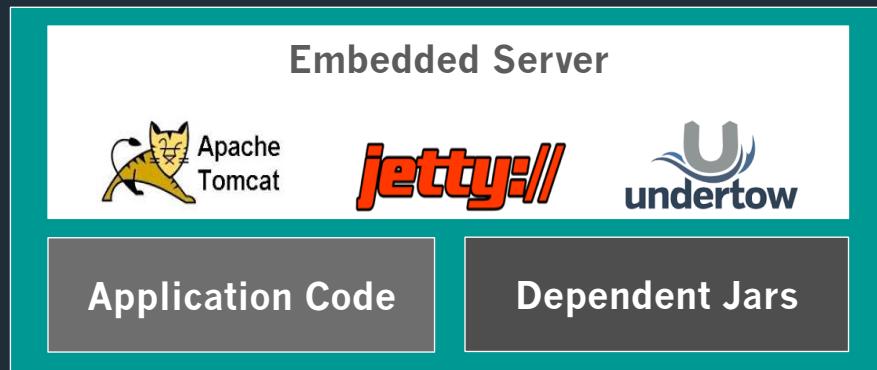
Are the version numbers compatible with each other?
Is the list of dependencies complete?

```
<dependencies>
  <dependency>
    <groupId>org.springframework</groupId>
    <artifactId>spring-web</artifactId>
    <version>4.1.6.RELEASE</version>
  </dependency>
  <dependency>
    <groupId>org.thymeleaf</groupId>
    <artifactId>thymeleaf-spring4</artifactId>
    <version>2.1.4.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.

Packaging – Make Jar not War

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>
```

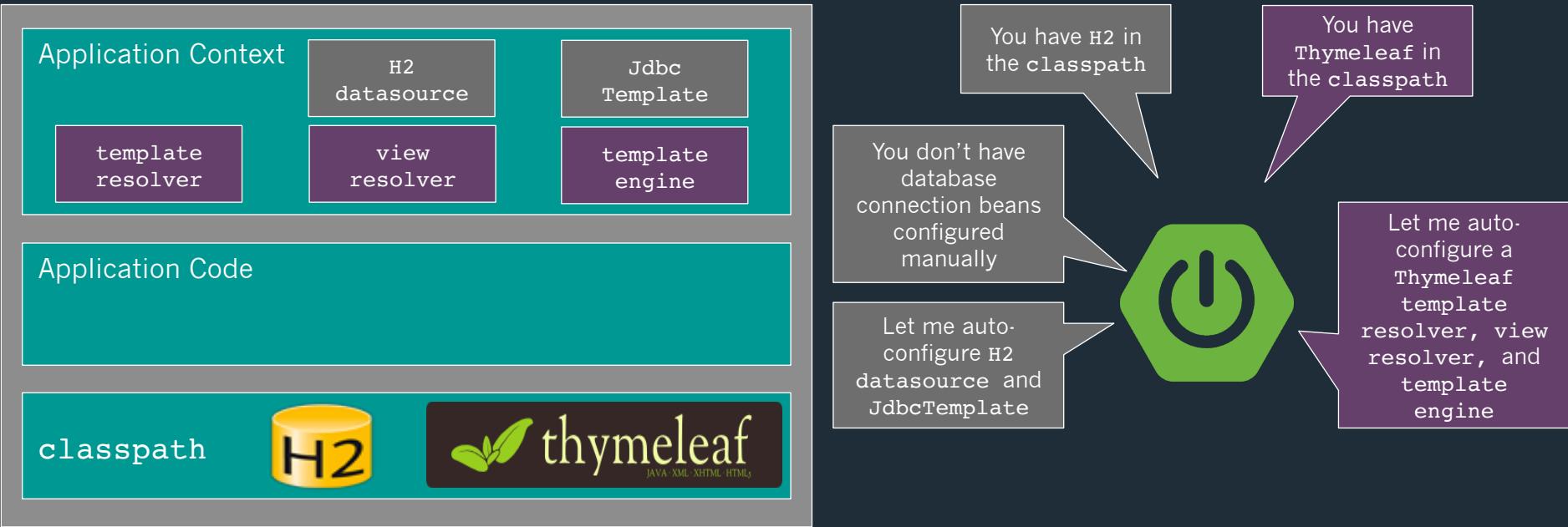
Benefits of executable *fat jars*

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



Auto-Configuration

Automatically configures application based on the `classpath`



Actuator

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>
```

Actuator

- Services exposed through
 - HTTP endpoints for Spring MVC Applications
 - shell interface
 - JMX Beans



Types of Actuator Endpoints

Actuator endpoints can be organized into three categories

Configuration

- /beans
- /autoconfig
- /env
- /configprops
- /controller

Metrics

- /metrics
- /trace
- /dump

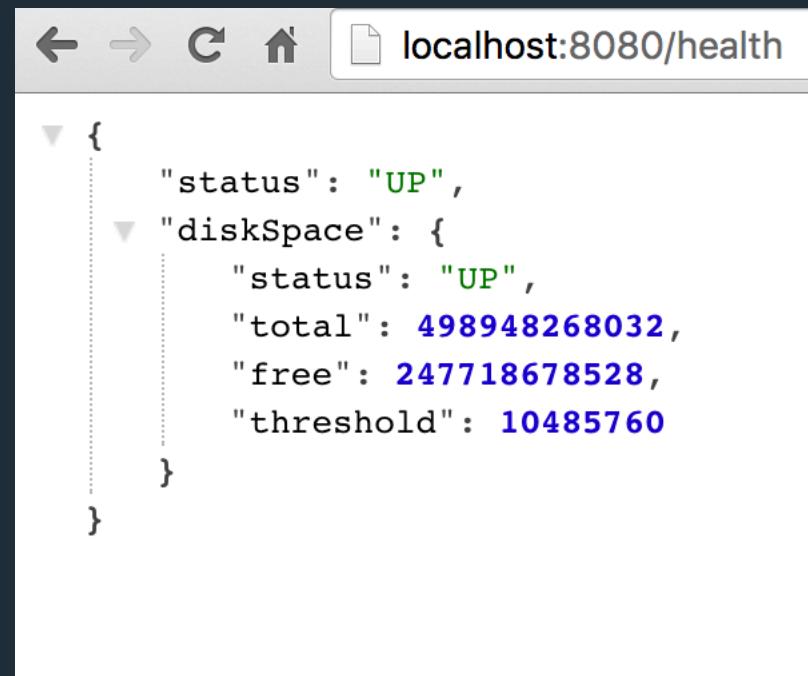
Miscellaneous

- /shutdown
- /info

/health

Reports health metrics for the application

- Each check returns a Health object
 - status
 - UP
 - DOWN
 - UNKNOWN
 - OUT_OF_SERVICE
 - Possibly with details
- Plugin own health definitions



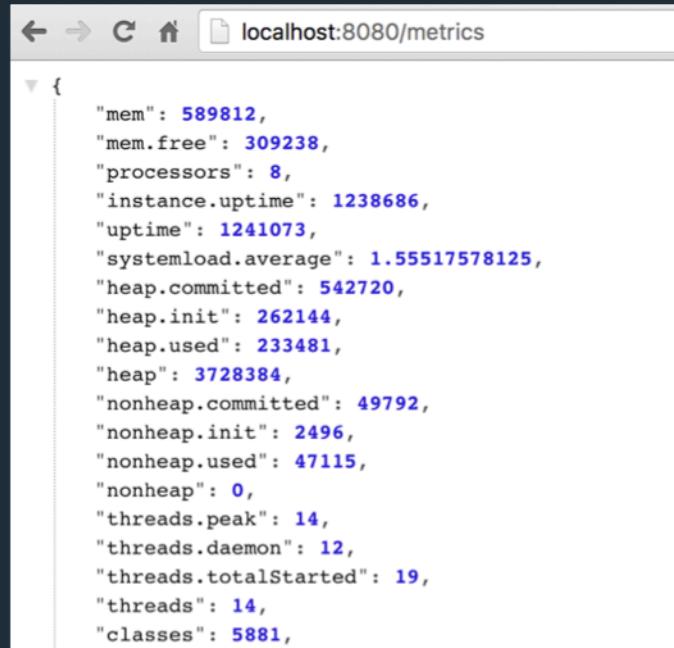
A screenshot of a web browser window displaying the JSON output of the /health endpoint. The URL in the address bar is "localhost:8080/health". The JSON response is as follows:

```
{  
  "status": "UP",  
  "diskSpace": {  
    "status": "UP",  
    "total": 498948268032,  
    "free": 247718678528,  
    "threshold": 10485760  
  }  
}
```

/metrics

Reports application metrics such as

- Memory usage and
- HTTP request counters



A screenshot of a web browser window displaying the JSON output of the /metrics endpoint. The URL in the address bar is "localhost:8080/metrics". The JSON response contains various system and application metrics, many of which are highlighted in blue, likely indicating they are links or part of a copy-pasteable code block.

```
{  
    "mem": 589812,  
    "mem.free": 309238,  
    "processors": 8,  
    "instance.uptime": 1238686,  
    "uptime": 1241073,  
    "systemload.average": 1.55517578125,  
    "heap.committed": 542720,  
    "heap.init": 262144,  
    "heap.used": 233481,  
    "heap": 3728384,  
    "nonheap.committed": 49792,  
    "nonheap.init": 2496,  
    "nonheap.used": 47115,  
    "nonheap": 0,  
    "threads.peak": 14,  
    "threads.daemon": 12,  
    "threads.totalStarted": 19,  
    "threads": 14,  
    "classes": 5881,  
}
```

Spring Boot & Cloud Foundry



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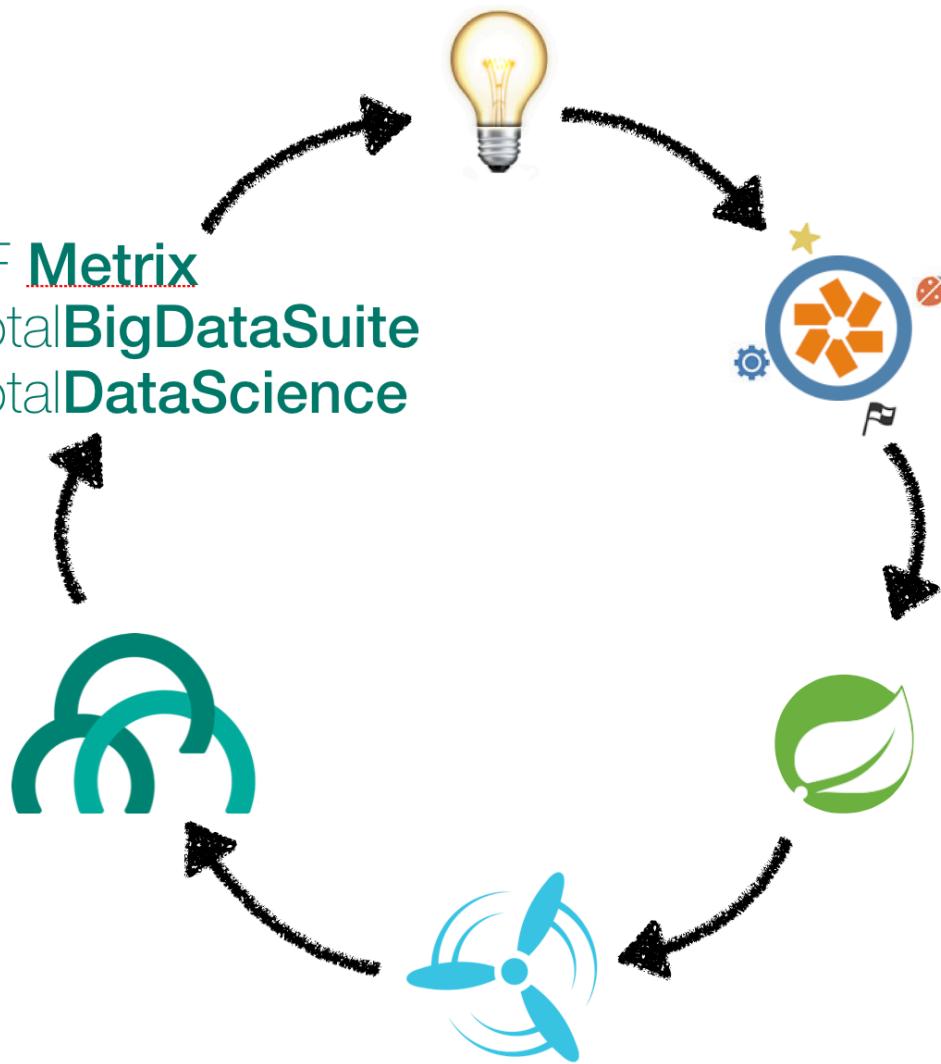
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Contract-first SOAP service development with Spring Web Services

Jersey (JAX-RS)

the Jersey RESTful Web Services framework

PCF **Metrix**
Pivotal**BigDataSuite**
Pivotal**DataScience**



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