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# Spring and Cloud Applications

People matter, results count.

## Objectives

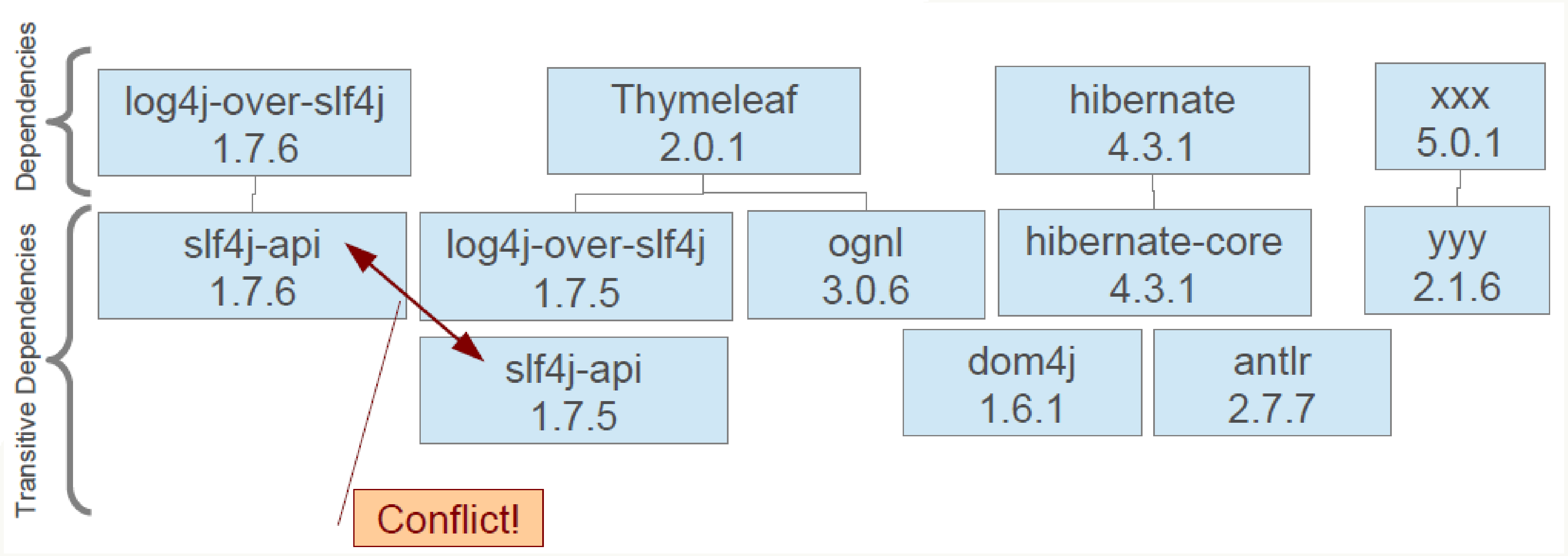
- Purpose:
  - Use Spring IO and Spring Boot
  - Configure and run applications using Profiles
- Product:
  - Spring IO, Spring Boot are not essentials for Cloud application
  - But they simplify code and dependency management
  - So cloud deployment is much easier
- Process:
  - Making JVM Cloud application eaiser.

## Table of Contents

## SPRING IO

# What is Spring IO?

- Working with open source libraries can be challenging
  - Transitive Dependencies - OS libraries that depend on other libraries
  - Need Maven, Gradle, etc. to manage, but still difficult



## Spring IO

- Defines a set of Maven library dependencies
  - For Spring and other commonly used JARs
  - Version-set known to work together

"Bill of Materials"

```
<dependencyManagement>
    <dependencies>
        <dependency>
            <groupId>io.spring.platform</groupId>
            <artifactId>platform-bom</artifactId>
            <version>1.0.1.RELEASE</version>
            <type>pom</type>
            <scope>import</scope>
        </dependency>
    </dependencies>
</dependencyManagement>
```

Use Gradle if you prefer

## Using Spring IO

- Now define Maven dependencies in usual way
  - No need for <version>, Spring IO will decide

```
<dependencies>
    <dependency>
        <groupId>org.springframework.data</groupId>
        <artifactId>spring-data-commons</artifactId>
    </dependency>

    <dependency>
        <groupId>org.hsqldb</groupId>
        <artifactId>hsqldb</artifactId>
    </dependency>
    ...
</dependencies>
```

No version needed!

## what Dependencies are Available?

- Many, many of the JARs commonly used in Spring JVM applications
  - Spring, Groovy core and project JARs, ...
  - Apache Commons, Tiles, Solr, Velocity, Tomcat, ...
  - JPA, hibernate, EclipseLink, MyBatis, NoSQL DBs...
  - Logging, OXM, JSON, Metrics, ...
  - Web, Servlets, Jetty, Thymeleaf ...

- Presently, 480+ JAR versions are managed

http://docs.spring.io/platform/docs/current/refernce/htmlsingle/#appendix-dependency-version

# SPRING BOOT

## what is Spring Boot?

- A quick way to start building a Spring project
- An opinionated runtime for Spring projects
- Supports different project types, like Web and Batch
- Can be used to create containerless apps

- It is not:
  - A code generator
  - An IDE plug-in

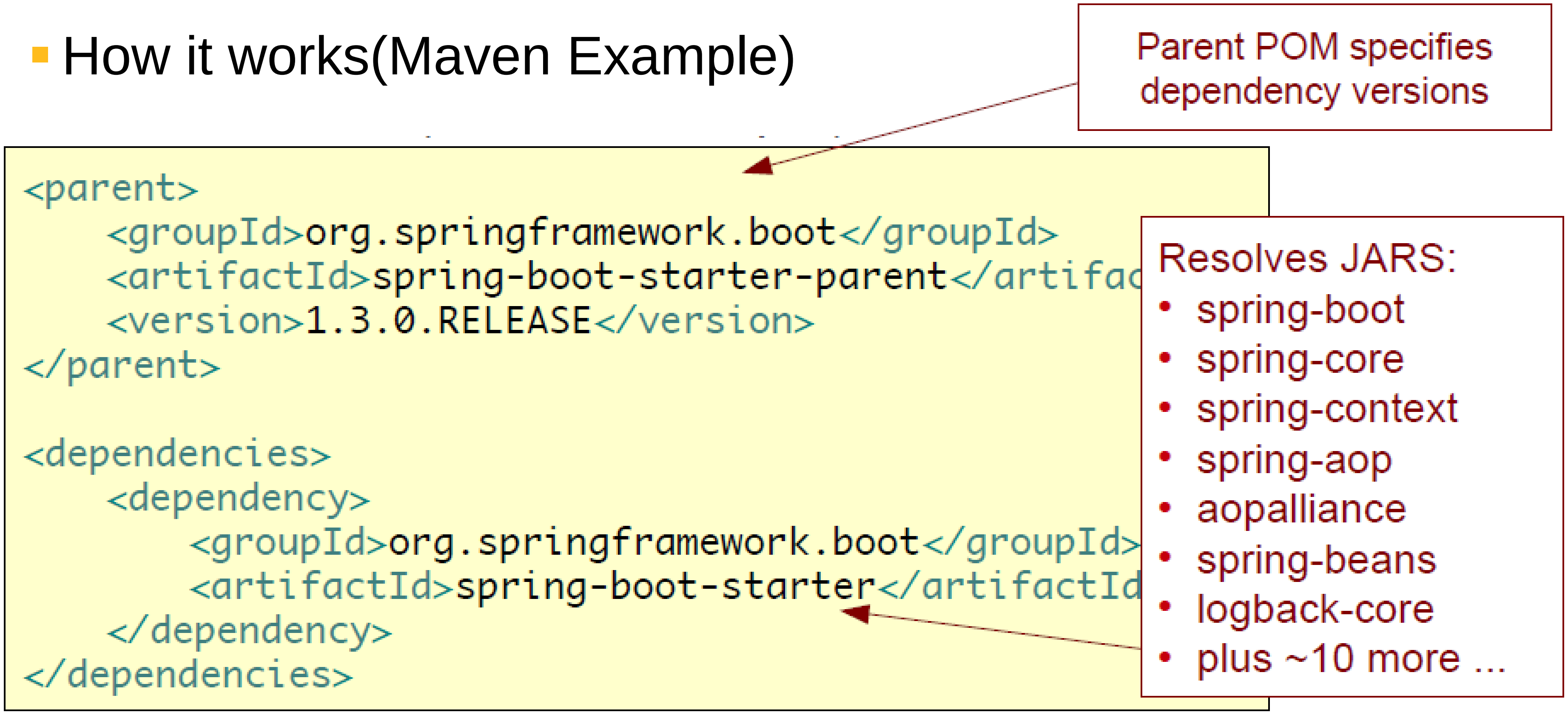
## Opinionated Runtime?

- Spring Boot uses sensible defaults, mostly based on the classpath contents
- For example:
  - Sets up a JPA Entity Manager Factory if a JPA implementation is on the classpath
  - Creates a default Spring MVC setup, is Spring MVC is on the classpath
- Everything can be overridden very easily
  - But most of the time not needed
  - Relies heavily on Spring 4 @ Conditional annotation

## SPRING BOOT DEMO

# Spring Boot Dependency Management

- How it works(Maven Example)



Parent POM specifies dependency versions

```
<parent>
    <groupId>org.springframework.boot</groupId>
    <artifactId>spring-boot-starter-parent</artifac
    <version>1.3.0.RELEASE</version>
</parent>

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

Resolves JARS:
- spring-boot
- spring-core
- spring-context
- spring-aop
- aopalliance
- spring-beans
- logback-core
- plus ~10 more ...

- Eliminates need to document standard dependencies
- See http://projects.spring.io/spring-boot for latest version

## Spring Boot - Adding Dependencies

- To add capabilities, add additional "started" dependencies:

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

Adds JARS:
- spring-web
- spring-webmvc
- jackson-databind
- hibernate-validator
- tomcat-embed
- *plus transitive dependencies*

- For full list of Spring boot Starter dependencies see:
- https://githuh.com/spring-projects/spring-boot/tree/master/spring-boot-starters

## Spring Boot JPA Example

- Dependencies

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

    <dependency>
        <groupId>org.hsqldb</groupId>
        <artifactId>hsqldb</artifactId>
    </dependency>
</dependencies>
```

*Starter* dependency set for RDBMS application: JDBC, JPA, Hibernate

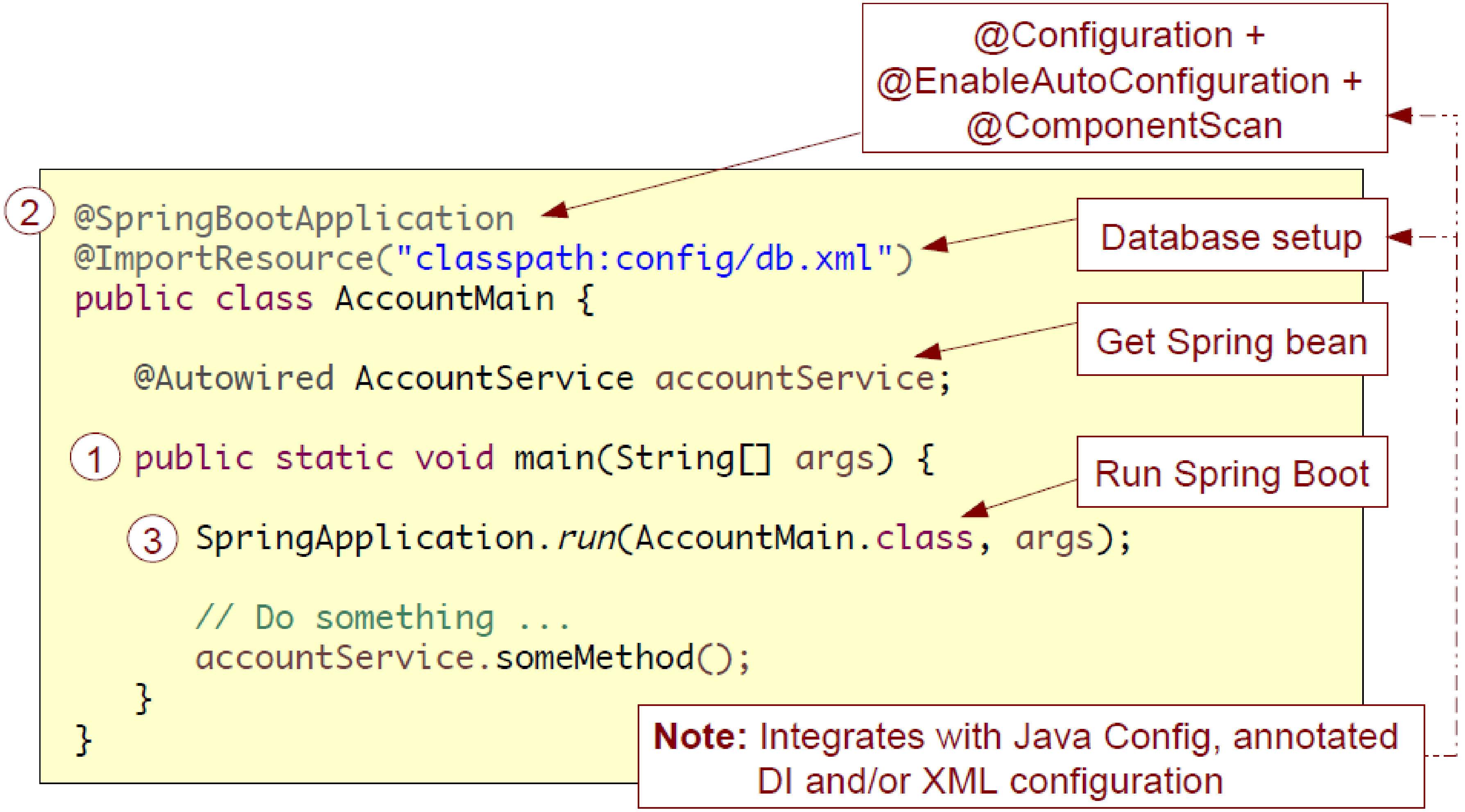
HSQL Database

# Programming Spring Boot

- Run application using a main() method ①
  - Like we used to before containers!
- @SpringBootApplication ②
  - Enables automatic configuration: @EnableAutoConfiguration
    - Spring Boot scans classpath, setting up typical defaults
  - marks class as a @Configuration class
  - Enabled @ComponentScan from current base package
- SpringApplication class ③
- Initiates Spring Boot
- Tells Spring Boot which class to start with
  - Usually this class

① ② ③ see next slide ….

# Example Spring Boot Application



```java
@SpringBootApplication
@ImportResource("classpath:config/db.xml")
public class AccountMain {

   @Autowired AccountService accountService;

   public static void main(String[] args) {

      SpringApplication.run(AccountMain.class, args);

      // Do something ...
      accountService.someMethod();
   }
}
```

**Note:** Integrates with Java Config, annotated DI and/or XML configuration

# Web application using Spring Boot

- Define Spring Controllers in usual way
- Add spring-boot-starter-web dependency

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

– The main() program starts up embedded Tomcat

```
2 @SpringBootApplication
  public class WebMain {
1   public static void main(String[] args) {
        SpringApplication.run (WebMain.class, args);   3
    }
}
```

- Spring Boot detects web-artifacts, starts Tomcat
- This method *only* returns when Tomcat shuts down

# Run as a War

- Two Steps:
  - Change Packaging to war: <packaging>war</packaging>
  - Extend Spring boot's Servlet Initializer

```
@SpringBootApplication
public class WebMain extends SpringBootServletInitializer {

   // Can still have main() if you like
   public static void main(String[] args) { ... }

   @Override
   protected SpringApplicationBuilder
         configure(SpringApplicationBuilder application) {
      return application.sources(WebMain.class);
   }

}
```

No WEB.XML!  (Unless you want)

## Overriding Defaults

- Spring Boot takes an opinionated approach to application decisions
  - Example Opinion: Web applications should use Tomcat
  - Example Opinion: JPA application should use Hibernate
- what if you have different opinions?
  - Use Jetty, use EclipseLink
- No Problem!
  - Simply override the dependencies (See next)

## Overriding Defaults - Option 1

- Use Jetty instead of Tomcat
  - Just add its starter dependency

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

   <!-- Use Jetty as embedded servlet container not Tomcat -->
   <dependency>
      <groupId>org.springframework.boot</groupId>
      <artifactId>spring-boot-starter-jetty</artifactId>
   </dependency>

   ...
</dependencies>
```

# Overriding Defaults - Option 2a

- Use EclipseLink instead of Hibernate
  1. Change maven dependency
  2. Override the default entityManagerFactory bean
     - Normally created by Spring Boot, will use yours instead

persistence.xml

```xml
<!-- Minimal persistence.xml, not needed with Hibernate, but
     EclipseLink adheres to the specification. -->
<persistence xmlns="http://java.sun.com/xml/ns/persistence" ...>
   <persistence-unit name="account">
   </persistence-unit>
</persistence>
```

Maven

```xml
<!-- Add EclipseLink dependency -->
<dependency>
  <groupId>org.eclipse.persistence</groupId>
  <artifactId>org.eclipse.persistence.jpa</artifactId>
</dependency>
```

## Overriding Defaults - Option 2b

```
@Configuration
public class JpaConfig {
   @Bean
   public EntityManagerFactoryBean emf (DataSource dataSource) {
      JpaVendorAdapter adapter = new EclipseLinkJpaVendorAdapter();
      // Set desired properties.

      Properties props = new Properties();
      // Set desired properties

      LocalContainerEntityManagerFactoryBean emfb =
        new LocalContainerEntityManagerFactoryBean();
      emfb.setDataSource(dataSource);
      emfb.setPersistenceUnitName("account");
      emfb.setJpaProperties(props);
      emfb.setJpaVendorAdapter(adapter);
      return emfb;
   }
}
```

Spring Java Config – remember to enable component-scanning

## Spring Boot Maven Properties

- Can override product versions using properties in your Maven POM or Gradle build file

```
<properties>
    <!-- Get Spring Boot to set Java version -->
    <java.version>1.7</java.version>

    <!-- Class containing main() -->
    <start-class>io.pivotal.cf.Application</start-class>

    <!-- Servlet version – downgrade to 2.x if you prefer -->
    <servlet-api.version>3.0.1</servlet-api.version>

    <!-- Tomcat version -->
    <tomcat.version>7.0.55</tomcat.version>
</properties>
```

https://github.com/spring-projects/spring-boot/blob/master/spring-boot-dependencies/pom.xml

## Spring Boot Application Properties

- Spring Boot automatically looks for application.properties
  - Or use application.yml if you prefer YAML
- Use predefined properties to control Spring Boot

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

application.properties

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

application.yml

No tabs!

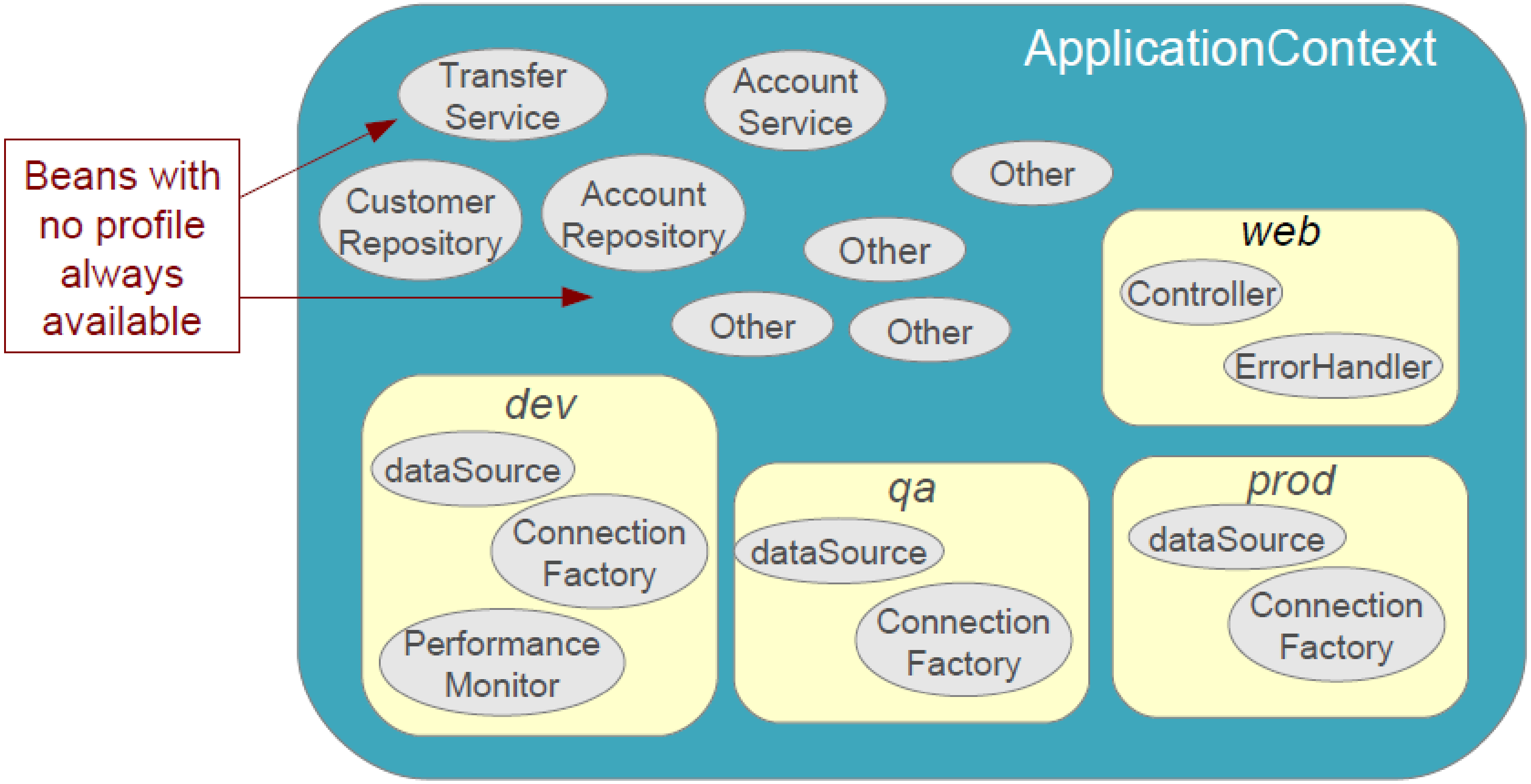
## SPRING PROFILES

## Spring Profiles

- Part of Spring Framework since 3.0
  - Allow multiple different configurations
  - Select the ones you want by selecting one or more profiles
  - integrated into Spring Testing framework also

- Beans can be grouped into Profiles
  - Profiles can represent purpose: "web", "offline"
  - Or environment: "dev","qa","uat","prod","cloud"
  - Or implementation: "jdbc","jpa"
  - Beans included /excluded based on profile membership

## Example Profiles



## Defining profiles

- Add @Profile annotation to component or configuration
- Or qualify <beans> in XML

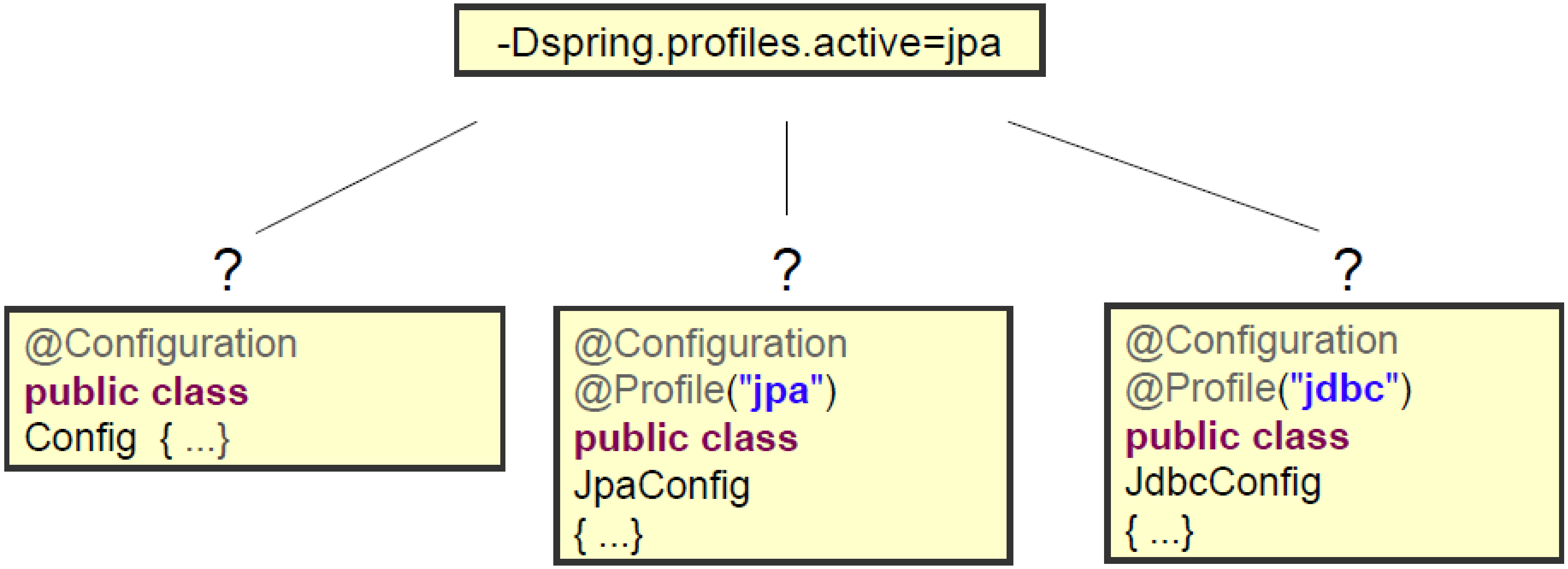
```
@Configuration
@Profile("dev")
public class DevConfig {

    @Bean
    public DataSource dataSource() {
        ...
    }
}
```

```
@Repository
@Profile("jdbc")
public class
JdbcAccountRepository
   { ...}
```

```
<beans xmlns=...>
   <!-- Available to all profiles →
   <bean id="transferService" … />
   ...
   <beans profile="jdbc">
      <bean id="dataSource" … />
   </beans>
   <beans profile="jpa"> ... </beans>
</beans>
```

## QUIZ

- Which of the following is/are selected?



```
-Dspring.profiles.active=jpa
```

```
@Configuration
public class
Config { ...}
```

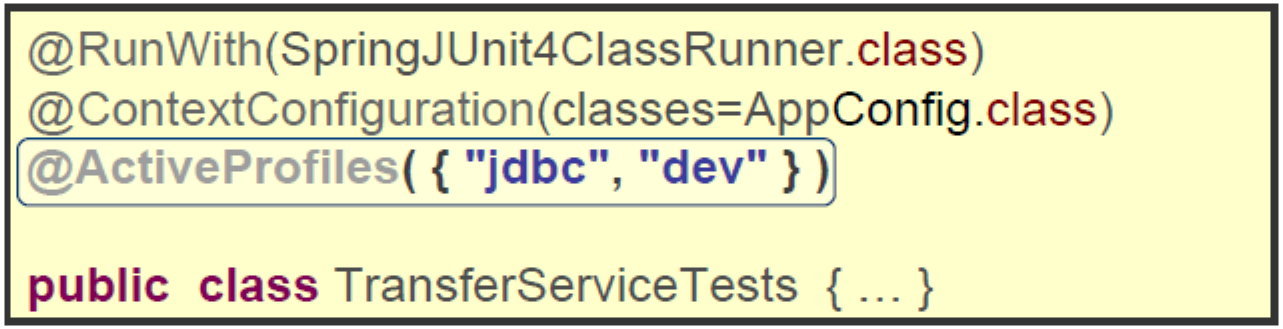
```
@Configuration
@Profile("jpa")
public class
JpaConfig
{ ...}
```

```
@Configuration
@Profile("jdbc")
public class
JdbcConfig
{ ...}
```

## Activating Profiles For a Test

- @ActiveProfiles inside Spring-driven test class
  - Define one or more profiles
  - Beans associated with that profile are instantiated
  - Also beans not associated with any profile

- Example: Two profiles activated -jdbc and dev



```
@RunWith(SpringJUnit4ClassRunner.class)
@ContextConfiguration(classes=AppConfig.class)
@ActiveProfiles( { "jdbc", "dev" } )

public  class TransferServiceTests  { … }
```

## Active Profiles

- Profiles may be activated at execution-time
  - System property

```
-Dspring.profiles.active=dev,jpa
```

- Profiles activated via Cloud Foundry environment variable
  - CLI or manifest

```
cf  set-env <app>  spring.profiles.active  dev
```

- Java buildpack automatically activates "cloud" profile
  - You can activate additional profiles as needed

## SPRING CLOUD

## Spring Cloud

- Umbrella project for several sub-projects
  - Implement useful patterns required when building distributed, cloud-based applications
  - ***Cloud Connectors:*** access bound service information
  - ***Cloud Starters:*** for Spring Boot support
  - ***Cloud Config:*** centralized configuration management
  - ***Cloud Netflix:*** integration with Netflix OSS components
    - Eureka, Hystrix, Zuul, Achaius, ...
  - ***Cloud Bus***: distributed messaging for services instances
  - ***Spring Cloud*** for Cloud Foundry
  - Spring Cloud *for Amazon Web Services*

## Spring Cloud Connectors Summary

```
// Obtain the Cloud abstraction:
Cloud cloud = new CloudFactory().getCloud();

// Obtain a bound service (no JSON parsing of VCAP_SERVICES):
DataSource ds1, ds2;
ds1 = cloud.getSingletonServiceConnector(DataSource.class, null);

// Obtain a specific bound service by name:
ds2 = cloud.getServiceConnector("mydb", DataSource.class, null);

// Information about this instance:
ApplicationInstanceInfo info = cloud.getApplicationInstanceInfo();
logger.info("App id=" + info.getAppId()
                      + ", instance=" + info.getInstanceId());

// Cloud properties:
Properties p = cloud.getCloudProperties();
```

## Recap

Spring

IO

Profile

Boot

Cloud

Netflix

Umbrella

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