More Configuration

Deeper Look into Spring's Java Configuration Capability

1.18.5

Objectives

After completing this lesson, you should be able to do the following

- Use External Properties to control Configuration
- Demonstrate the purpose of Profiles
- Use the Spring Expression Language (SpEL)

Agenda

- **External Properties**
- Profiles
- Spring Expression Language
- Inter-Bean Dependencies

Setting property values

- Consider this bean definition from the previous module:

```
@Bean
public DataSource dataSource() {
  BasicDataSource ds = new BasicDataSource();
  ds.setDriverClassName("org.postgresql.Driver");
  ds.setUrl("jdbc:postgresql://localhost/transfer" );
  ds.setUser("transfer-app");
  ds.setPassword("secret45" );
  return ds;
}
```

- Hard-coding these properties is a Bad practice
  - Better practice is to "externalize" these properties
  - One way to "externalize" them is by using property files

Spring's Environment Abstraction – 1

- **`Environment`** bean represents loaded properties from runtime environment

- Properties derived from various sources, in this order:
  - JVM System Properties - **`System.getProperty()`**
  - System Environment Variables - **`System.getenv()`**
  - Java Properties Files

Spring's Environment Abstraction – 2

```
@Configuration
public class DbConfig {

  @Bean public DataSource dataSource(Environment env) {
    BasicDataSource ds = new BasicDataSource();
    ds.setDriverClassName(  env.getProperty( "db.driver" ));
    ds.setUrl( env.getProperty( "db.url" ));
    ds.setUser( env.getProperty( "db.user" ));
    ds.setPassword( env.getProperty( "db.password" ));
    return ds;
  }
}
```

Inject `Environment` bean like any other Spring Bean

Fetch property values from environment

```
db.driver=org.postgresql.Driver
db.url=jdbc:postgresql:localhost/transfer
db.user=transfer-app
db.password=secret45
```

app.properties

Property Sources

- Environment bean obtains values from “property sources”
  - *Environment variables* and *Java System Properties* always populated automatically
  - **@PropertySource** contributes *additional* properties
  - Available resource prefixes: **`classpath: file: http:`**

```
@Configuration
@PropertySource ( “classpath:/com/organization/config/app.properties” )
@PropertySource ( “file:config/local.properties” )
public class ApplicationConfig {
  ...
}
```

Adds properties from these files *in addition* to environment variables and system properties

Accessing Properties using @Value

```
@Configuration
public class DbConfig {
  @Bean
  public DataSource dataSource(
        @Value("${db.driver}") String driver,
        @Value("${db.url}") String url,
        @Value("${db.user}") String user,
        @Value("${db.password}") String pwd) {
    BasicDataSource ds = new BasicDataSource();
    ds.setDriverClassName(  driver);
    ds.setUrl( url);
    ds.setUser( user);
    ds.setPassword( pwd ));
    return ds;
  }
}
```

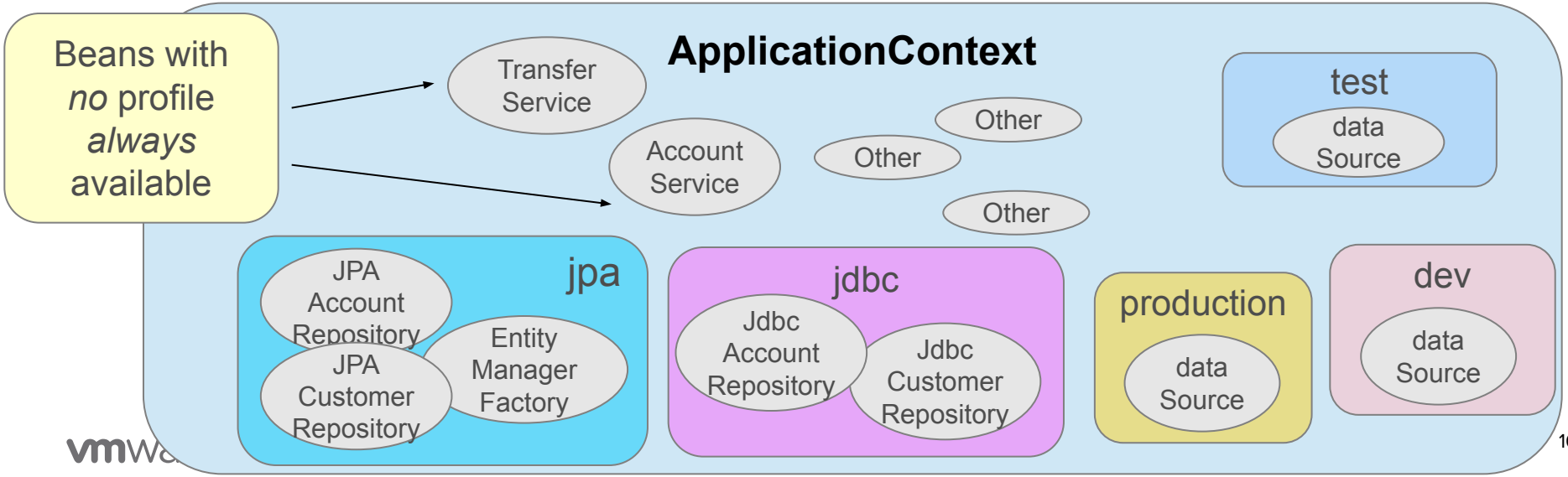
Convenient alternative to explicitly using *Environment* bean

Agenda

- External Properties
- **Profiles**
- Spring Expression Language
- Inter-Bean Dependencies

Profiles - Beans can be grouped into Profiles

- Profiles can represent environment: dev, test, production
- Or implementation: “jdbc”, “jpa”
- Or deployment platform: “on-premise”, “cloud”
- Beans included / excluded based on profile membership



Defining Profiles – 1

- Using @Profile annotation on configuration class
  - Everything in Configuration belong to the profile

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

    @Bean
    public DataSource dataSource() {
        EmbeddedDatabaseBuilder builder = new EmbeddedDatabaseBuilder();
        return builder.setName("testdb")
                .setType(EmbeddedDatabaseType.HSQL)
                .addScript("classpath:/testdb/schema.db")
                .addScript("classpath:/testdb/test-data.db").build();
    }
    …
```

Nothing in this configuration will be used *unless* "embedded" profile is chosen as one of the active profiles

H2, Derby are also supported

Defining Profiles - 2

- Using @Profile annotation on @Bean methods

```
@Configuration
public class DataSourceConfig {

  @Bean(name="dataSource")
  @Profile("embedded")
  public DataSource dataSourceForDev() {
    EmbeddedDatabaseBuilder builder = new EmbeddedDatabaseBuilder();
    return builder.setName("testdb") ...
  }

  @Bean(name="dataSource")
  @Profile("!embedded")
  public DataSource dataSourceForProd() {
    BasicDataSource dataSource = new BasicDataSource();
    ...
    return dataSource;
  }
```

Explicit bean-name overrides method name

Both profiles define *same* bean name, so only *one* profile should be activated at a time.

Defining Profiles - 3

- Beans when a profile is *not* active

```
@Configuration
@Profile("cloud")
public class DevConfig {
    …
}
```

If *cloud* is **active** profile

```
@Configuration
@Profile("!cloud")
public class ProdConfig {
    …
}
```

If *cloud* is **inactive** profile

Not cloud – use exclamation !

Ways to Activate Profiles

- Profiles must be activated at run-time
  - System property via command-line

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

  - System property programmatically

```
System.setProperty("spring.profiles.active", "embedded,jpa");
SpringApplication.run(AppConfig.class);
```

  - Integration Test *only*: **`@ActiveProfiles`** (will be covered later)

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
{ ...}
```

Property Source selection

- `@Profile` can control which `@PropertySources` are included in the Environment

```
@Configuration
@Profile("local")
@PropertySource ( "local.properties" )
class DevConfig { … }
```

```
db.driver=org.postgresql.Driver
db.url=jdbc:postgresql://localhost/transfer
db.user=transfer-app
db.password=secret45
```

local.properties

```
@Configuration
@Profile("cloud")
@PropertySource ( "cloud.properties" )
class ProdConfig { … }
```

```
db.driver=org.postgresql.Driver
db.url=jdbc:postgresql://prod/transfer
db.user=transfer-app
db.password=secret99
```

cloud.properties

Agenda

- External Properties
- Profiles
- **Spring Expression Language**
- Inter-Bean Dependencies

Spring Expression Language

- SpEL for short
  - Inspired by the Expression Language used in Spring WebFlow
  - Based on Unified Expression Language used by JSP and JSF
- Pluggable/extendable by other Spring-based frameworks

This is just a brief introduction, for full details see:
http://docs.spring.io/spring/docs/current/spring-framework-reference/html/expressions.html

SpEL examples – Using @Value

```
@Configuration
class TaxConfig  {

   @Value("#{ systemProperties['user.region'] }") String region;

   @Bean
   public TaxCalculator taxCalculator1() {
      return new TaxCalculator( region );
   }

   @Bean
   public TaxCalculator taxCalculator2
            (@Value("#{ systemProperties['user.region'] }") String region, …)  {
      return  new TaxCalculator( region );
   }
   …
```

Option 1: Set an attribute then use it

Option 2: Pass as a bean method argument

SpEL – Accessing Spring Beans

```
class StrategyBean {
    private KeyGenerator gen = new KeyGenerator.getInstance("Blowfish");
    public KeyGenerator getKeyGenerator()  { return gen; }
}
```

```
@Configuration
class StrategyConfig {

    @Bean public StrategyBean strategyBean() {
        return new StrategyBean();
    }
}
```

```
@Configuration
@Import(StrategyConfig.class)
class AnotherConfig
{
    @Value("#{strategyBean.keyGenerator}") KeyGenerator kgen;
    …
}
```

Accessing Properties

- Can access properties via the *environment*
  - These are equivalent

```
@Value("${daily.limit}")
int maxTransfersPerDay;
```

```
@Value("#{environment['daily.limit']}")
int maxTransfersPerDay;
```

- Properties are Strings

```
@Value("#{new Integer(environment['daily.limit']) * 2}")              // OK
@Value("#{new java.net.URL(environment['home.page']).host}")   // OK
@Value("${daily.limit *2}")       // NOT OK
```

Fallback Values

Elvis lives!

- Providing a fall-back value
  - If **`daily.limit`** undefined, use fall-back value

```
@Autowired
public TransferServiceImpl(@Value("${daily.limit : 100000}") int max) {
    this.maxTransfersPerDay = max;
}
```

Equivalent operators

  - For SpEL, use the "Elvis" operator **?:**

```
@Autowired
public setLimit(@Value("#{environment['daily.limit'] ?: 100000}") int max) {
    this.maxTransfersPerDay = max;
}
```

`x ?: y` is short for **`x != null ? x : y`**

SpEL

- EL Attributes can be:
  - Spring beans (like *strategyBean*)
  - Implicit references
    - Spring's *environment, systemProperties, systemEnvironment* available by default
    - Others depending on context
- SpEL allows to create custom functions and references
  - Widely used in Spring projects
    - Spring Security, Spring WebFlow
    - Spring Batch, Spring Integration
  - Each may add *their own* implicit references

Agenda

- External Properties
- Profiles
- Spring Expression Language
- **Inter-Bean Dependencies**

Quiz

Spring beans may depend on other beans.
Which is the appropriate implementation(s)?

```
@Bean
public AccountRepository accountRepository()  {
    return new JdbcAccountRepository();
}

@Bean
public TransferService transferService1(AccountRepository accountRepository) {
     return new TransferServiceImpl(accountRepository);
}

@Bean
public TransferService transferService1() {
     return new TransferServiceImpl(accountRepository());
}

@Bean
public TransferService transferService2() {
    return new TransferServiceImpl( new JdbcAccountRepository()  );
}
```

1. DI through bean method arg?

2. Method call?

3. New instance?

Background: “Full” @Configuration vs. “Lite” @Bean mode

How are Spring bean instances configured?

- **“Full” configuration**: Using `@Configuration` classes where beans are declared.
- **“Lite” beans**: Declaring beans where the `@Configuration` annotation has proxy method disabled.

See more here:
https://docs.spring.io/spring-framework/docs/current/reference/html/core.html#beans-java-basic-concepts

Full @Configuration - Injecting Beans by method call

Recall: *Singleton* is default scope

```
@Bean
public AccountRepository accountRepository() {
    return new JdbcAccountRepository();
}

@Bean
public TransferService transferService() {
    return new TransferServiceImpl(accountRepository());
}

@Bean
public AccountService accountService() {
    return new AccountServiceImpl(accountRepository());
}
```

Singleton

Method called 2 additional times

Both calls resolve to the `accountRepository` singleton, through a “subclassed proxy”

Full @Configuration implementation

- At startup time, a *subclass* of the `@Configuration` annotated bean is created
  - Subclass performs *scope-control*
    - Only calls *super* on *first* invocation of singleton bean method

```
@Configuration
public class AppConfig {
    @Bean public AccountRepository accountRepository() { ... }
    @Bean public TransferService transferService() { ... }
}
```

inherits from

```
public class AppConfig$$EnhancerByCGLIB$ extends AppConfig {
  public AccountRepository accountRepository() {  // ... }
  public TransferService transferService() {  // ... }
}
```

Inheritance-based Subclasses

- Child class is the entry point

```
public class AppConfig$$EnhancerByCGLIB$ extends AppConfig {

  public AccountRepository accountRepository() {
    // if bean is in the applicationContext, then return bean
    // else call super.accountRepository(), store bean in context, return bean
  }

  public TransferService transferService() {
    // if bean is in the applicationContext, then return bean
    // else call super.transferService(), store bean in context, return bean
  }
```

Java Configuration uses *cglib* for inheritance-based subclasses

“Lite” @Bean mode

- No subclass proxy generated
- Beans created in a `@Configuration` class with the `proxyBeanMethods` disabled

```
@Configuration(proxyBeanMethods = false)
public class SomeClass {
    @Bean public AccountRepository accountRepository() { ... }
    ...
}
```

Injecting a Bean through Bean Method DI

```
@Bean
public AccountRepository accountRepository() {
    return new JdbcAccountRepository();
}

@Bean
public TransferService transferService(AccountRepository accountRepository) {
    return new TransferServiceImpl(accountRepository);
}

@Bean
public AccountService accountService(AccountRepository accountRepository) {
    return new AccountServiceImpl(accountRepository);
}
```

Recall: *Singleton* is default scope

Singleton

Dependency Injection through Bean Argument

Can be used with either Full Configuration*, or Lite Beans configuration

Injecting a Bean through Bean Method DI - Lite @Bean

```
@Configuration(proxyBeanMethods = false)
public class SomeClass {

   @Bean
   public AccountRepository accountRepository() {
      return new JdbcAccountRepository();
   }

   @Bean
   public TransferService transferService(AccountRepository accountRepository) {
      return new TransferServiceImpl(accountRepository);
   }

   @Bean
   public AccountService accountService(AccountRepository accountRepository) {
      return new AccountServiceImpl(accountRepository);
   }
}
```

Suppress the subclassed proxy, results in Lite Beans

“Lite” Beans limitation

```
@Configuration(proxyBeanMethods = false)
public class SomeClass {

   @Bean
   public AccountRepository accountRepository() {
      return new JdbcAccountRepository();
   }

   @Bean
   public TransferService transferService() {
      return new TransferServiceImpl(accountRepository());
   }

   @Bean
   public AccountService accountService(accountRepository()) {
      return new AccountServiceImpl(accountRepository);
   }
}
```

Do not do this!

Direct instantiation - Do not do it!

```
@Configuration
public class SomeClass {

   @Bean
   public AccountRepository accountRepository()  {
      return new JdbcAccountRepository();
   }

   @Bean
   public TransferService transferService()  {
      return new TransferServiceImpl(accountRepository());
   }

   @Bean
   public AccountService accountService()  {
      return new AccountServiceImpl(new JdbcAccountRepository() );
   }
}
```

OK

Do not do this!

Summary

- Property values are easily externalized using Spring's Environment abstraction
- Profiles are used to group sets of beans
- Spring Expression Language

There is no Lab for this module!