**Objectives**

* Demonstrate creation of Spring Boot Application
  + Spring initializr, https://start.spring.io, @SpringBootApplication, SpringApplication.run()
    - Ref - https://start.spring.io
* Explain the need and benefits of Spring Boot
  + Makes Java development easy, avoids tedious development steps, reduces development time, avoids writing boilerplate code, provides embedded tomcat server, avoid XML configuration
    - Ref - https://www.journaldev.com/7969/spring-boot-tutorial
* Demonstrate loading bean from spring configuration file
  + Spring configuration xml, spring xml schema spring-beans.xsd, <bean>, id, class, <constructor-arg>, <property>, name, value, ClassPathXmlApplicationContext, ApplicationContext, context.getBean(), singleton scope, prototype scope
    - Ref - https://docs.spring.io/spring-framework/docs/current/spring-framework-reference/core.html
    - IoC Container - https://docs.spring.io/spring-framework/docs/current/spring-framework-reference/core.html#beans
    - Scopes - https://docs.spring.io/spring-framework/docs/current/spring-framework-reference/core.html#beans-factory-scopes
    - Constructor Injection - https://docs.spring.io/spring-framework/docs/current/spring-framework-reference/core.html#beans-constructor-injection
    - Setter method injection - https://docs.spring.io/spring-framework/docs/current/spring-framework-reference/core.html#beans-setter-injection
* Demonstrate inclusion of logging in Spring Boot Application
  + application.properties, logging.level, logging.pattern, server.port, LoggerFactory, Logger, log levels (trace, debug, info, warn, error)
    - Ref - https://docs.spring.io/spring-boot/docs/current/reference/html/boot-features-logging.html

# Cognizant Digital Nurture 4.0 Deep Skilling

## Spring Rest HandsOn

**Hands on 1**

**Create a Spring Web Project using Maven**   
  
Follow steps below to create a project: 

1. Go to <https://start.spring.io/>
2. Change Group as “com.cognizant”
3. Change Artifact Id as “spring-learn”
4. Select Spring Boot DevTools and Spring Web
5. Create and download the project as zip
6. Extract the zip in root folder to Eclipse Workspace
7. Build the project using ‘mvn clean package -Dhttp.proxyHost=proxy.cognizant.com -Dhttp.proxyPort=6050 -Dhttps.proxyHost=proxy.cognizant.com -Dhttps.proxyPort=6050 -Dhttp.proxyUser=123456’ command in command line
8. Import the project in Eclipse "File > Import > Maven > Existing Maven Projects > Click Browse and select extracted folder > Finish"
9. Include logs to verify if main() method of SpringLearnApplication.
10. Run the SpringLearnApplication class.

SME to walk through the following aspects related to the project created:

1. src/main/java - Folder with application code
2. src/main/resources - Folder for application configuration
3. src/test/java - Folder with code for testing the application
4. SpringLearnApplication.java - Walkthrough the main() method.
5. Purpose of @SpringBootApplication annotation
6. pom.xml
   1. Walkthrough all the configuration defined in XML file
   2. Open 'Dependency Hierarchy' and show the dependency tree.

**Solution :**

**Steps:**

1. Go to <https://start.spring.io>
2. Change Group to com.cognizant
3. Set Artifact Id as spring-learn
4. Select the following dependencies:
   * Spring Boot DevTools
   * Spring Web
5. Click "Generate" and download the ZIP file.
6. Extract the ZIP file to your Eclipse workspace directory.
7. Open Command Prompt and navigate to the project directory.
8. Run the following Maven build command:

mvn clean package -Dhttp.proxyHost=proxy.cognizant.com -Dhttp.proxyPort=6050 -Dhttps.proxyHost=proxy.cognizant.com -Dhttps.proxyPort=6050 -Dhttp.proxyUser=123456

1. Open Eclipse and import the project:
   * File > Import > Maven > Existing Maven Projects > Browse to extracted folder > Finish
2. Open SpringLearnApplication.java and add a log statement to confirm execution:

private static final Logger LOGGER = LoggerFactory.getLogger(SpringLearnApplication.class);

public static void main(String[] args) {

SpringApplication.run(SpringLearnApplication.class, args);

LOGGER.info("Inside main");

}

1. Run the SpringLearnApplication class.

**SME Walkthrough Checklist:**

1. **src/main/java** – Contains application source code.
2. **src/main/resources** – Holds configuration files like application.properties.
3. **src/test/java** – Contains test classes for unit/integration testing.
4. **SpringLearnApplication.java** –
   * Entry point for the Spring Boot application.
   * Contains the main() method.
   * Annotated with @SpringBootApplication which is a combination of:
     + @Configuration
     + @EnableAutoConfiguration
     + @ComponentScan
5. **pom.xml** –
   * Lists all dependencies and plugins for the project.
   * SME should demonstrate:
     + Project coordinates (groupId, artifactId, version)
     + Spring Boot starter dependencies
     + Maven build plugins
     + The dependency tree under the "Dependency Hierarchy" tab

**Hands on 2**

**Spring Core – Load SimpleDateFormat from Spring Configuration XML**   
  
SimpleDateFormat with the pattern ‘dd/MM/yyyy’ is created in multiple places of an application. To avoid creation of SimpleDateFormat in multiple places, define a bean in Spring XML Configuration file and retrieve the date.  
  
Follow steps below to implement:

* Create spring configuration file date-format.xml in src/main/resources folder of 'spring-learn' project
* Open https://docs.spring.io/spring-framework/docs/current/spring-framework-reference/core.html#beans-factory-metadata
* Copy the XML defined in the section of previous step URL and paste it into date-format.xml
* Define bean tag in the XML with for date format. Refer code below.

<?xml version="1.0" encoding="UTF-8"?>

<beans xmlns="http://www.springframework.org/schema/beans"

    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

    xsi:schemaLocation="http://www.springframework.org/schema/beans

        https://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="dateFormat" class="java.text.SimpleDateFormat">

<constructor-arg value="dd/MM/yyyy" />

</bean>

</beans>

* Create new method displayDate() in SpringLearnApplication.java
* In displayDate() method create the ApplicationContext. Refer code below:

ApplicationContext context = new ClassPathXmlApplicationContext("date-format.xml");

* Get the dateFormat using getBean() method. Refer code below.

SimpleDateFormat format = context.getBean("dateFormat", SimpleDateFormat.class);

* Using the format variable try to parse string '31/12/2018' to Date class and display the result using System.out.println.
* Run the application as 'Java Application' and check the result in console log output.

**Troubleshooting Tips**   
  
If the tomcat port has a conflict and the server is not starting include the below property in application.properties file in src/main/resources folder.

**Solution :**

**Steps:**

1. Create date-format.xml in src/main/resources of the spring-learn project.
2. Add the following configuration to date-format.xml:

<?xml version="1.0" encoding="UTF-8"?>

<beans xmlns="http://www.springframework.org/schema/beans"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xsi:schemaLocation="http://www.springframework.org/schema/beans

https://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="dateFormat" class="java.text.SimpleDateFormat">

<constructor-arg value="dd/MM/yyyy" />

</bean>

</beans>

In SpringLearnApplication.java, add a new method:

public static void displayDate() {

ApplicationContext context = new ClassPathXmlApplicationContext("date-format.xml");

SimpleDateFormat format = context.getBean("dateFormat", SimpleDateFormat.class);

try {

Date date = format.parse("31/12/2018");

System.out.println(date);

} catch (ParseException e) {

e.printStackTrace();

}

}

1. Call displayDate() from the main() method.
2. Run the application as a Java Application and check the console for the parsed date.

**Hands on 3**

**Spring Core - Incorporate Logging**   
  
Incorporate logging in the Spring Boot project created in previous hands on. Refer steps below:

* Create application.properties if not yet created in src/main/resources folder
* Add below lines in application.properties

logging.level.org.springframework=info

logging.level.com.cognizant.springlearn=debug

logging.pattern.console=%d{yyMMdd}|%d{HH:mm:ss.SSS}|%-20.20thread|%5p|%-25.25logger{25}|%25M|%m%n

* In SpringLearnApplication.java include the following imports:

import org.slf4j.Logger;

import org.slf4j.LoggerFactory;

* Include the below static variable in SpringLearnApplication.java:

private static final Logger LOGGER = LoggerFactory.getLogger(SpringLearnApplication.class);

* Include info log on start and end of method. Debug log for displaying the date (refer code below)

public void displayDate() {

    LOGGER.info(“START”);

    //..

    LOGGER.debug(date);

    //..

    LOGGER.info(“END”);

}

**IMPORTANT NOTE:** Going forward all methods should incorporate logging as specified above. **Never** use System.out.println().

**Solution :**

1. Create application.properties in src/main/resources if it doesn't exist.
2. Add the following properties to configure logging:

logging.level.org.springframework=info

logging.level.com.cognizant.springlearn=debug

logging.pattern.console=%d{yyMMdd}|%d{HH:mm:ss.SSS}|%-20.20thread|%5p|%-25.25logger{25}|%25M|%m%n

In SpringLearnApplication.java, add the required imports:

import org.slf4j.Logger;

import org.slf4j.LoggerFactory;

Define a logger instance:

private static final Logger LOGGER = LoggerFactory.getLogger(SpringLearnApplication.class);

Update the displayDate() method to include logging:

public static void displayDate() {

LOGGER.info("START");

ApplicationContext context = new ClassPathXmlApplicationContext("date-format.xml");

SimpleDateFormat format = context.getBean("dateFormat", SimpleDateFormat.class);

try {

Date date = format.parse("31/12/2018");

LOGGER.debug("Parsed Date: {}", date);

} catch (ParseException e) {

LOGGER.error("ParseException occurred", e);

}

LOGGER.info("END");

}

**Hands on 4**

**Spring Core – Load Country from Spring Configuration XML**   
  
An airlines website is going to support booking on four countries. There will be a drop down on the home page of this website to select the respective country. It is also important to store the two-character ISO code of each country. 

|  |  |
| --- | --- |
| **Code** | **Name** |
| US | United States |
| DE | Germany |
| IN | India |
| JP | Japan |

Above data has to be stored in spring configuration file. Write a program to read this configuration file and display the details.  
  
Steps to implement

* Pick any one of your choice country to configure in Spring XML configuration named country.xml.
* Create a bean tag in spring configuration for country and set the property and values

    <bean id="country" class="com.cognizant.springlearn.Country">

        <property name="code" value="IN" />

        <property name="name" value="India" />

    </bean>

* Create Country class with following aspects:
  + Instance variables for code and name
  + Implement empty parameter constructor with inclusion of debug log within the constructor with log message as “Inside Country Constructor.”
  + Generate getters and setters with inclusion of debug with relevant message within each setter and getter method.
  + Generate toString() method
* Create a method displayCountry() in SpringLearnApplication.java, which will read the country bean from spring configuration file and display the country details. ClassPathXmlApplicationContext, ApplicationContext and context.getBean(“beanId”, Country.class). Refer sample code for displayCountry() method below.

ApplicationContext context = new ClassPathXmlApplicationContext("country.xml");

Country country = (Country) context.getBean("country", Country.class);

LOGGER.debug("Country : {}", country.toString());

* Invoke displayCountry() method in main() method of SpringLearnApplication.java.
* Execute main() method and check the logs to find out which constructors and methods were invoked.

SME to provide more detailing about the following aspects:

* bean tag, id attribute, class attribute, property tag, name attribute, value attribute
* ApplicationContext, ClassPathXmlApplicationContext
* What exactly happens when context.getBean() is invoked

**Solution :**

1. Create a file country.xml under src/main/resources.
2. Add the following Spring bean configuration:

<?xml version="1.0" encoding="UTF-8"?>

<beans xmlns="http://www.springframework.org/schema/beans"

xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"

xsi:schemaLocation="http://www.springframework.org/schema/beans

https://www.springframework.org/schema/beans/spring-beans.xsd">

<bean id="country" class="com.cognizant.springlearn.Country">

<property name="code" value="IN" />

<property name="name" value="India" />

</bean>

</beans>

Create a Country class under com.cognizant.springlearn package with the following:

public class Country {

private String code;

private String name;

public Country() {

LOGGER.debug("Inside Country Constructor.");

}

public String getCode() {

LOGGER.debug("Inside getCode()");

return code;

}

public void setCode(String code) {

LOGGER.debug("Inside setCode()");

this.code = code;

}

public String getName() {

LOGGER.debug("Inside getName()");

return name;

}

public void setName(String name) {

LOGGER.debug("Inside setName()");

this.name = name;

}

@Override

public String toString() {

return "Country [code=" + code + ", name=" + name + "]";

}

}

1. In SpringLearnApplication.java, add the following method:

public static void displayCountry() {

LOGGER.info("START");

ApplicationContext context = new ClassPathXmlApplicationContext("country.xml");

Country country = context.getBean("country", Country.class);

LOGGER.debug("Country : {}", country);

LOGGER.info("END");

}

1. Call displayCountry() from the main() method.
2. Run the program and observe the log to see which constructors and methods were triggered.

**Hands on 5**

**Spring Core – Demonstration of Singleton Scope and Prototype Scope**   
  
The Country bean done in the previous hands on will be used to demonstrate the scopes in Spring. Implement the steps below.  
  
**Follow steps below to demonstrate Singleton Scope**

* Include a line in displayCountry() to get country bean reference one more time from the same application context. Only the third line of the below code snippet should be copied and pasted.

ApplicationContext context = new ClassPathXmlApplicationContext("country.xml");

Country country = context.getBean("country", Country.class);

Country anotherCountry = context.getBean("country", Country.class);

* The constructor will be called only once, which means that only one instance of Country bean is created

**Follow steps below to demonstrate Prototype Scope**

* Include scope="prototype" attribute in bean definition xml.

<bean id="country" class="com.cognizant.springlearn.Country" scope="prototype">

* Run the application
* Constructor will be called twice, which means that two instances of country is created.

**Solution :**

### Singleton Scope Demonstration

**Steps:**

1. Open the country.xml file.
2. Ensure the country bean does **not** have a scope attribute (default is singleton).

<bean id="country" class="com.cognizant.springlearn.Country">

<property name="code" value="IN" />

<property name="name" value="India" />

</bean>

1. In SpringLearnApplication.java, update displayCountry() as below:

public static void displayCountry() {

LOGGER.info("START");

ApplicationContext context = new ClassPathXmlApplicationContext("country.xml");

Country country = context.getBean("country", Country.class);

Country anotherCountry = context.getBean("country", Country.class);

LOGGER.debug("Country : {}", country);

LOGGER.debug("Another Country : {}", anotherCountry);

LOGGER.info("END");

}

### Prototype Scope Demonstration

Modify the country.xml file to use prototype scope:

<bean id="country" class="com.cognizant.springlearn.Country" scope="prototype">

<property name="code" value="IN" />

<property name="name" value="India" />

</bean>

Rerun the same displayCountry() method.

**Hands on 6**

**Spring Core – Load list of countries from Spring Configuration XML**   
  
Our main objective was to retrieve the list of four countries for the airlines website. Refer steps below to get this incorporated. 

* Create a separate bean for each of the four country in country.xml.
* Create an ArrayList of Country in country.xml. Refer code below.

    <bean id="countryList" class="java.util.ArrayList">

        <constructor-arg>

            <list>

                <ref bean="in"></ref>

                <ref bean="us"></ref>

                <ref bean="de"></ref>

                <ref bean="jp"></ref>

            </list>

        </constructor-arg>

    </bean>

* Include new method displayCountries() in SpringLearnApplication.java
* In displayCountries() read the country list created above
* Display the list of countries as debug log.

SME to provide detailing on below aspects:

* <list>
* <ref>
* bean attribute

**IMPORTANT NOTE**: Do not forget to include the start and end logs in this new method.

**Solution :**

1. Open or create country.xml under src/main/resources.
2. Define four Country beans:

<bean id="in" class="com.cognizant.springlearn.Country">

<property name="code" value="IN" />

<property name="name" value="India" />

</bean>

<bean id="us" class="com.cognizant.springlearn.Country">

<property name="code" value="US" />

<property name="name" value="United States" />

</bean>

<bean id="de" class="com.cognizant.springlearn.Country">

<property name="code" value="DE" />

<property name="name" value="Germany" />

</bean>

<bean id="jp" class="com.cognizant.springlearn.Country">

<property name="code" value="JP" />

<property name="name" value="Japan" />

</bean>

Define a bean to hold the list of countries:

<bean id="countryList" class="java.util.ArrayList">

<constructor-arg>

<list>

<ref bean="in" />

<ref bean="us" />

<ref bean="de" />

<ref bean="jp" />

</list>

</constructor-arg>

</bean>

In SpringLearnApplication.java, add the following method:

public static void displayCountries() {

LOGGER.info("START");

ApplicationContext context = new ClassPathXmlApplicationContext("country.xml");

List<Country> countries = context.getBean("countryList", List.class);

LOGGER.debug("Countries: {}", countries);

LOGGER.info("END");

}

Call displayCountries() from the main() method.