CS544

LESSON 10
SOAP WEBSERVICES

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Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
March 28 **Lesson 1** Enterprise Architecture introduction and Spring Boot	March 29 **Lesson 2** Dependency injection AOP	March 30 **Lesson 3** JDBC JPA	March 31 **Lesson 4** JPA mapping 1	April 1 **Lesson 5** JPA mapping 2	April 2 **Lesson 6** JPA queries	April 3
April 4 **Lesson 7** Transactions	April 5 **Lesson 8** MongoDB	April 6 **Midterm Review**	April 7 **Midterm exam**	April 8 **Lesson 9** REST webservices	April 9 **Lesson 10** SOAP webservices	April 10
April 11 **Lesson 11** Messaging	April 12 **Lesson 12** Scheduling Events Configuration	April 13 **Lesson 13** Monitoring	April 14 **Lesson 14** Testing your application	April 15 **Final review**	April 16 **Final exam**	April 17
April 18 **Project**	April 19 **Project**	April 20 **Project**	April 21 **Presentations**			

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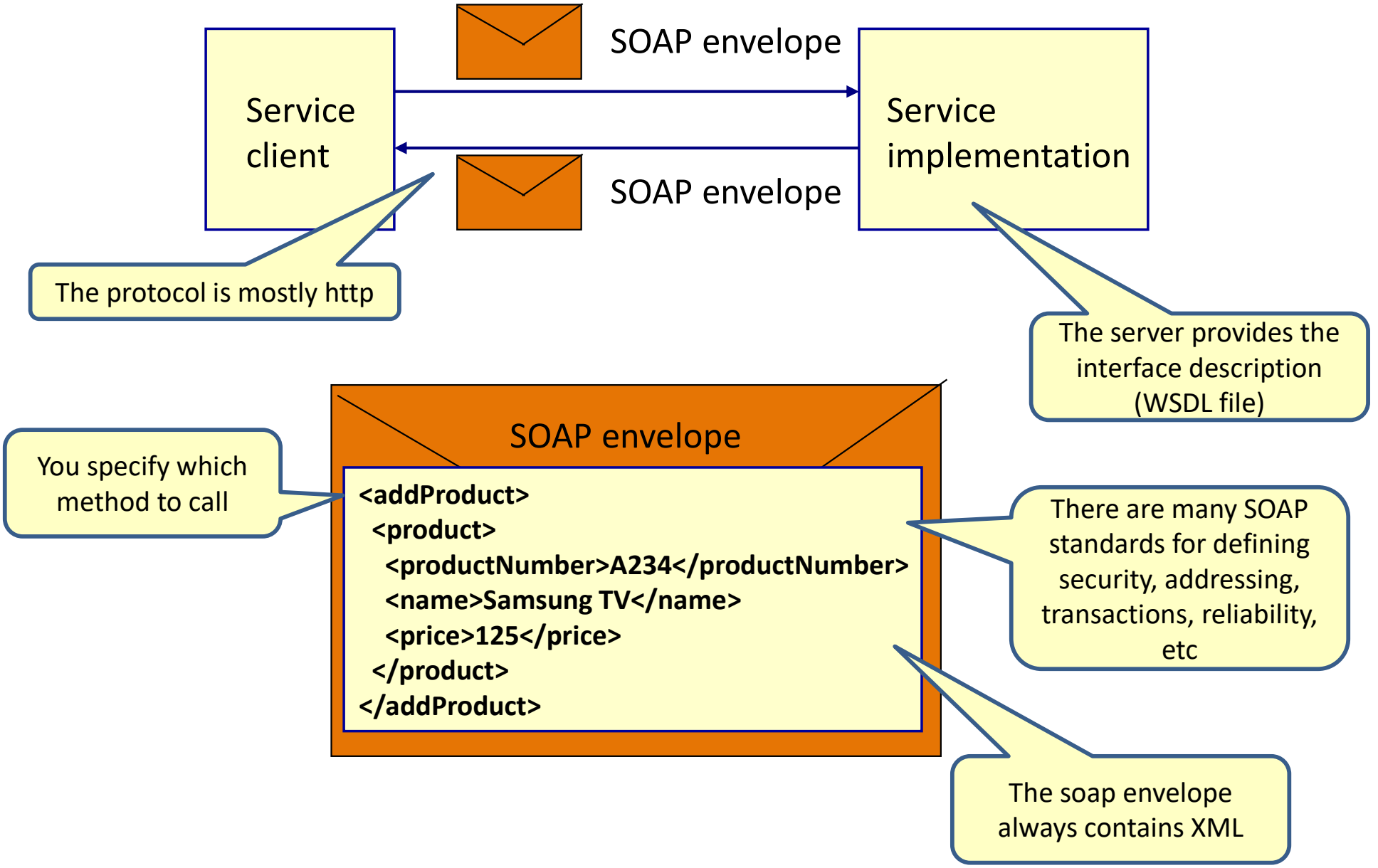
SOAP WEBSERVICES

Simple Object Access Protocol (SOAP)



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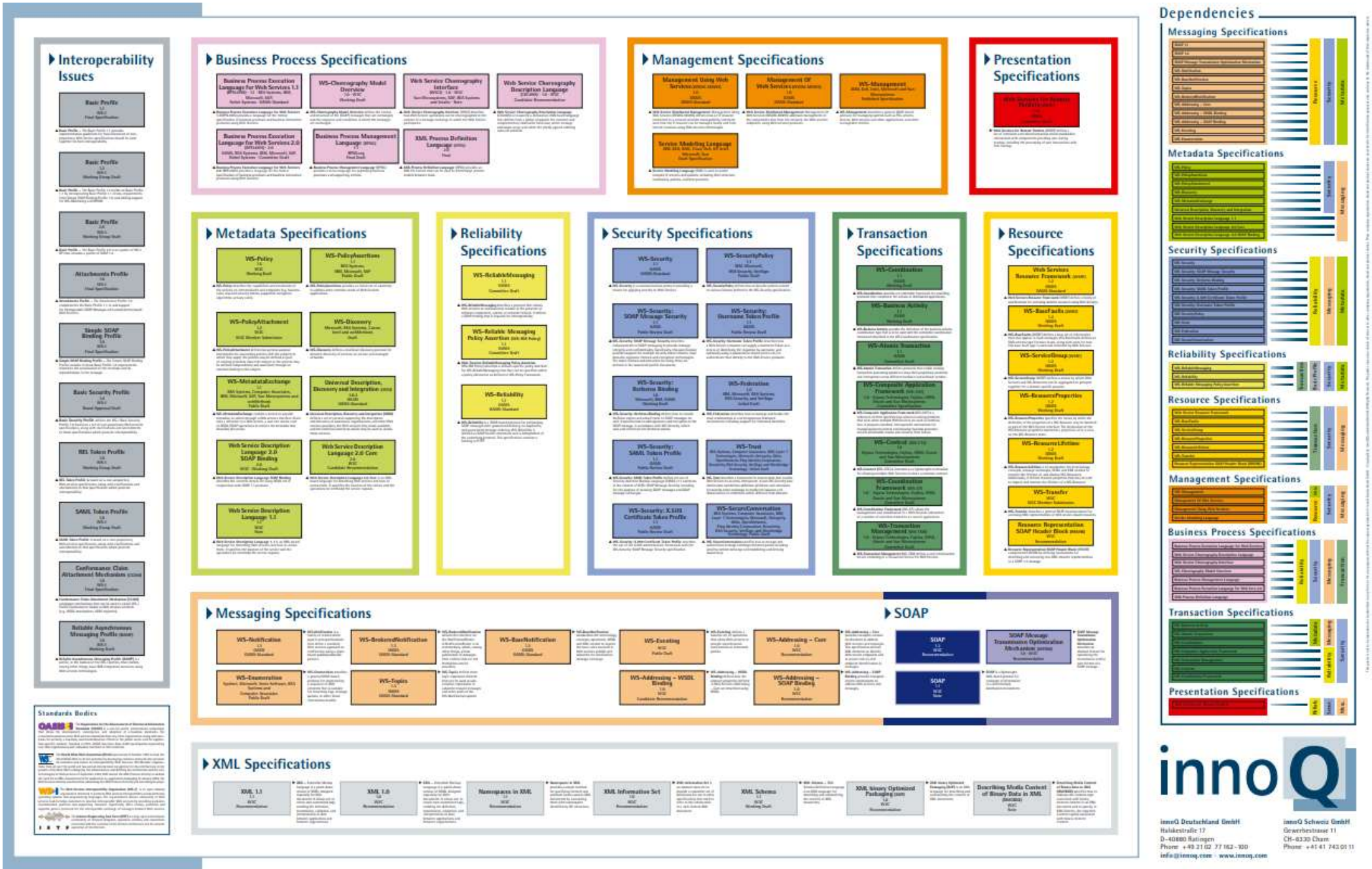
SOAP standards



Soap message

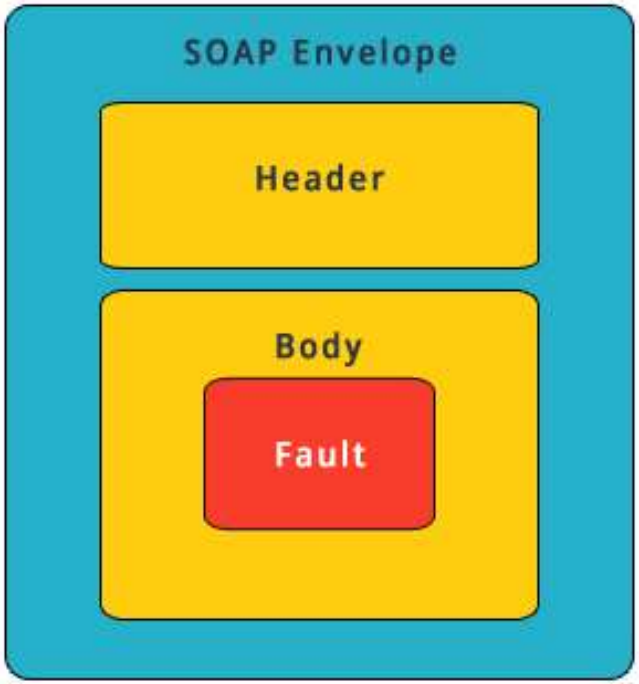
```
<?xml version = "1.0"?>
<SOAP-ENV:Envelope xmlns:SOAP-ENV = "http://www.w3.org/2001/12/soap-envelope"
   SOAP-ENV:encodingStyle = "http://www.w3.org/2001/12/soap-encoding">

   <SOAP-ENV:Header>
      ...
      ...
   </SOAP-ENV:Header>
   <SOAP-ENV:Body>
      ...
      ...
      <SOAP-ENV:Fault>
         ...
         ...
      </SOAP-ENV:Fault>
      ...
   </SOAP-ENV:Body>
</SOAP_ENV:Envelope>
```

Envelope (required)

Header (optional)

Body (required)

Fault (optional)



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SAOP request and response

Request

```
<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-envelope"
               xmlns:tem="http://tempuri.org/">
   <soap:Header/>
   <soap:Body>
      <tem:Add>
         <tem:intA>3</tem:intA>
         <tem:intB>6</tem:intB>
      </tem:Add>
   </soap:Body>
</soap:Envelope>
```

Response

```
<soap:Envelope xmlns:soap="http://www.w3.org/2003/05/soap-envelope"
               xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
               xmlns:xsd="http://www.w3.org/2001/XMLSchema">
   <soap:Body>
      <AddResponse xmlns="http://tempuri.org/">
         <AddResult>9</AddResult>
      </AddResponse>
   </soap:Body>
</soap:Envelope>
```

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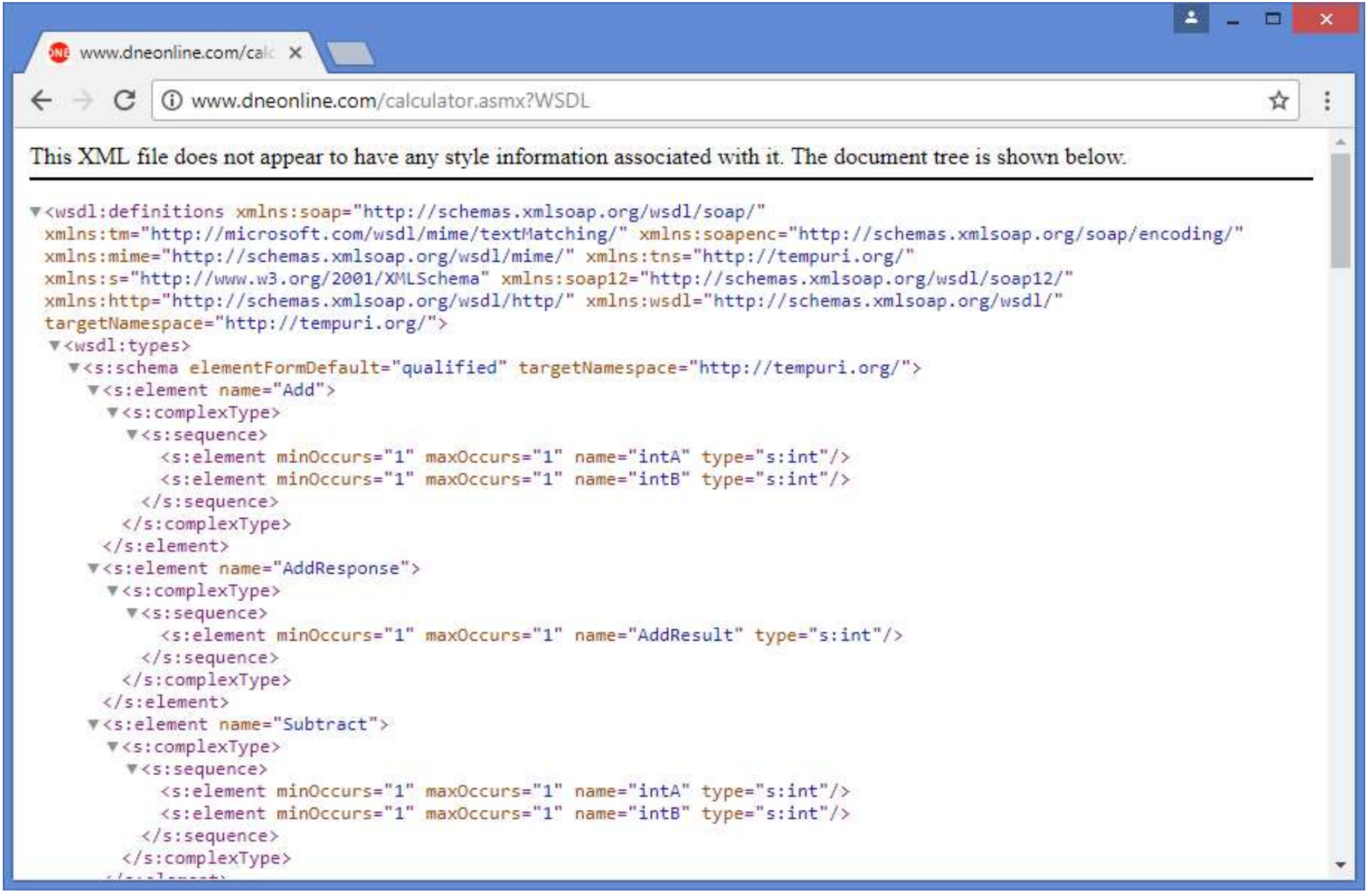
WSDL


www.dneonline.com/calc
www.dneonline.com/calculator.asmx?WSDL
This XML file does not appear to have any style information associated with it. The document tree is shown below.
<wsdl:definitions xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:tm="http://microsoft.com/wsdl/mime/textMatching/" xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/" xmlns:tns="http://tempuri.org/"
xmlns:s="http://www.w3.org/2001/XMLSchema" xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/"
xmlns:http="http://schemas.xmlsoap.org/wsdl/http/" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
targetNamespace="http://tempuri.org/">
<wsdl:types>
<s:schema elementFormDefault="qualified" targetNamespace="http://tempuri.org/">
<s:element name="Add">
<s:complexType>
<s:sequence>
<s:element minOccurs="1" maxOccurs="1" name="intA" type="s:int"/>
<s:element minOccurs="1" maxOccurs="1" name="intB" type="s:int"/>
</s:sequence>
</s:complexType>
</s:element>
<s:element name="AddResponse">
<s:complexType>
<s:sequence>
<s:element minOccurs="1" maxOccurs="1" name="AddResult" type="s:int"/>
</s:sequence>
</s:complexType>
</s:element>
<s:element name="Subtract">
<s:complexType>
<s:sequence>
<s:element minOccurs="1" maxOccurs="1" name="intA" type="s:int"/>
<s:element minOccurs="1" maxOccurs="1" name="intB" type="s:int"/>
</s:sequence>
</s:complexType>

SOAP vs. REST

- SOAP
  - SOAP envelope
  - Standards for
    - Security
    - Transactions
    - Reliability
    - Addressing
    - Etc
  - More complex as REST
  - XML messages
  - Standard way to describe the interface
    - WSDL
- REST
  - No support for
    - Security
    - Transactions
    - Reliability
    - Addressing
    - Etc
  - Simple
  - Http messages containing text, XML or JSON
  - No standard way to describe the interface

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SPRING SOAP WEBSERVICES

Spring WS

- In a contract first approach we need to:
  1. Create a xsd (XML schema) for our web service
  2. Generate Java classes based on the xsd
  3. Create implementation based on the generated Java classes

Spring SOAP libraries

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

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Start with xsd: Greeting.xsd

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema attributeFormDefault="unqualified"
  elementFormDefault="qualified"
  targetNamespace="http://springtraining/greeting"
  xmlns:tns="http://springtraining/greeting"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:complexType name="Person">
    <xs:sequence>
      <xs:element type="xs:string" name="FirstName" />
      <xs:element type="xs:string" name="LastName" />
    </xs:sequence>
  </xs:complexType>

  <xs:element name="GreetingRequest">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Person" type="tns:Person" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="GreetingResponse">
    <xs:complexType>
      <xs:sequence>
        <xs:element type="xs:string" name="Greeting" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

Namespaces

Start with xsd: Greeting.xsd

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema attributeFormDefault="unqualified"
  elementFormDefault="qualified"
  targetNamespace="http://springtraining/greeting"
  xmlns:tns="http://springtraining/greeting"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:complexType name="Person">
    <xs:sequence>
      <xs:element type="xs:string" name="FirstName" />
      <xs:element type="xs:string" name="LastName" />
    </xs:sequence>
  </xs:complexType>

  <xs:element name="GreetingRequest">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Person" type="tns:Person" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="GreetingResponse">
    <xs:complexType>
      <xs:sequence>
        <xs:element type="xs:string" name="Greeting" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

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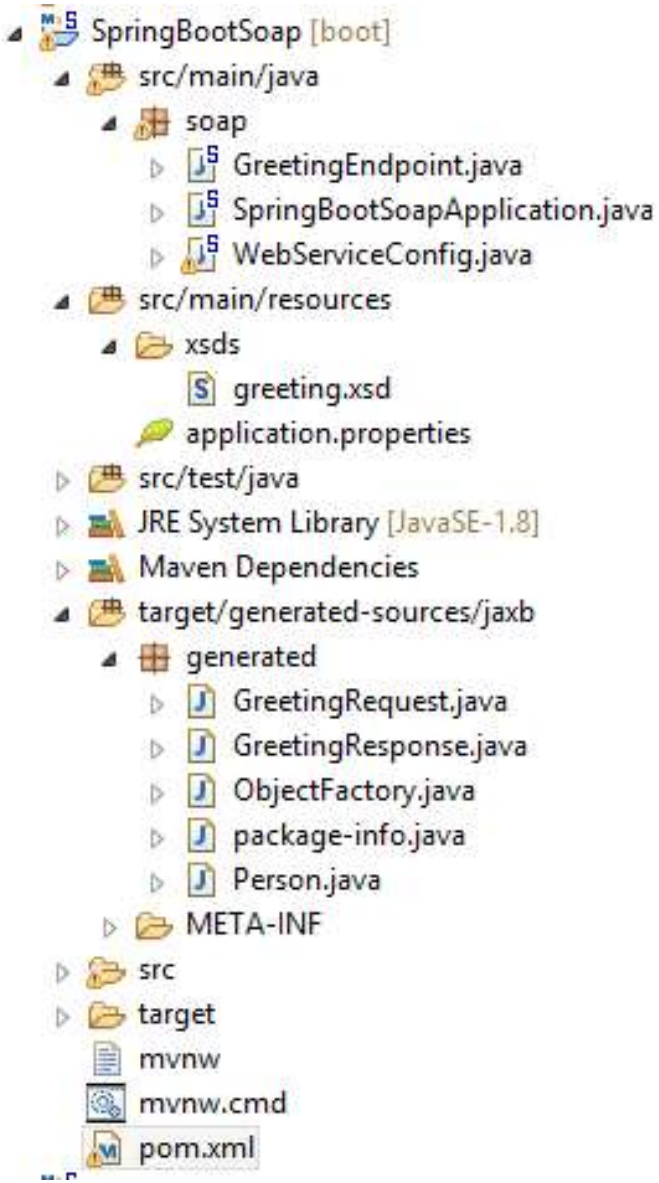
In POM file




```
<plugin>
  <groupId>org.codehaus.mojo</groupId>
  <artifactId>jaxb2-maven-plugin</artifactId>
  <version>2.3.1</version>
  <executions>
    <execution>
      <id>xjc-schema</id>
      <goals>
        <goal>xjc</goal>
      </goals>
    </execution>
  </executions>
  <configuration>
    <sources>
      <source>src/main/resources/xsds</source>
    </sources>
    <packageName>generated</packageName>
    <clearOutputDir>false</clearOutputDir>
  </configuration>
</plugin>
```

Maven plugin to generate Java classes out of xsd file

Generate Java classes from xsd

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema attributeFormDefault="unqualified"
  elementFormDefault="qualified"
  targetNamespace="http://springtraining/greeting"
  xmlns:tns="http://springtraining/greeting"
  xmlns:xs="http://www.w3.org/2001/XMLSchema">

  <xs:complexType name="Person">
    <xs:sequence>
      <xs:element type="xs:string" name="FirstName" />
      <xs:element type="xs:string" name="LastName" />
    </xs:sequence>
  </xs:complexType>

  <xs:element name="GreetingRequest">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="Person" type="tns:Person" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>

  <xs:element name="GreetingResponse">
    <xs:complexType>
      <xs:sequence>
        <xs:element type="xs:string" name="Greeting" />
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>
```

greeting.xsd

```java
@XmlAccessorType(
@XmlType(
@XmlRootElement(
public class GreetingRequest {
   ...
}
```

```java
@XmlAccessorType(
@XmlType(
public class Person {
   ...
}
```

```java
@XmlAccessorType(
@XmlType(
@XmlRootElement(
public class GreetingResponse {
   ...
}
```

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Generated classes

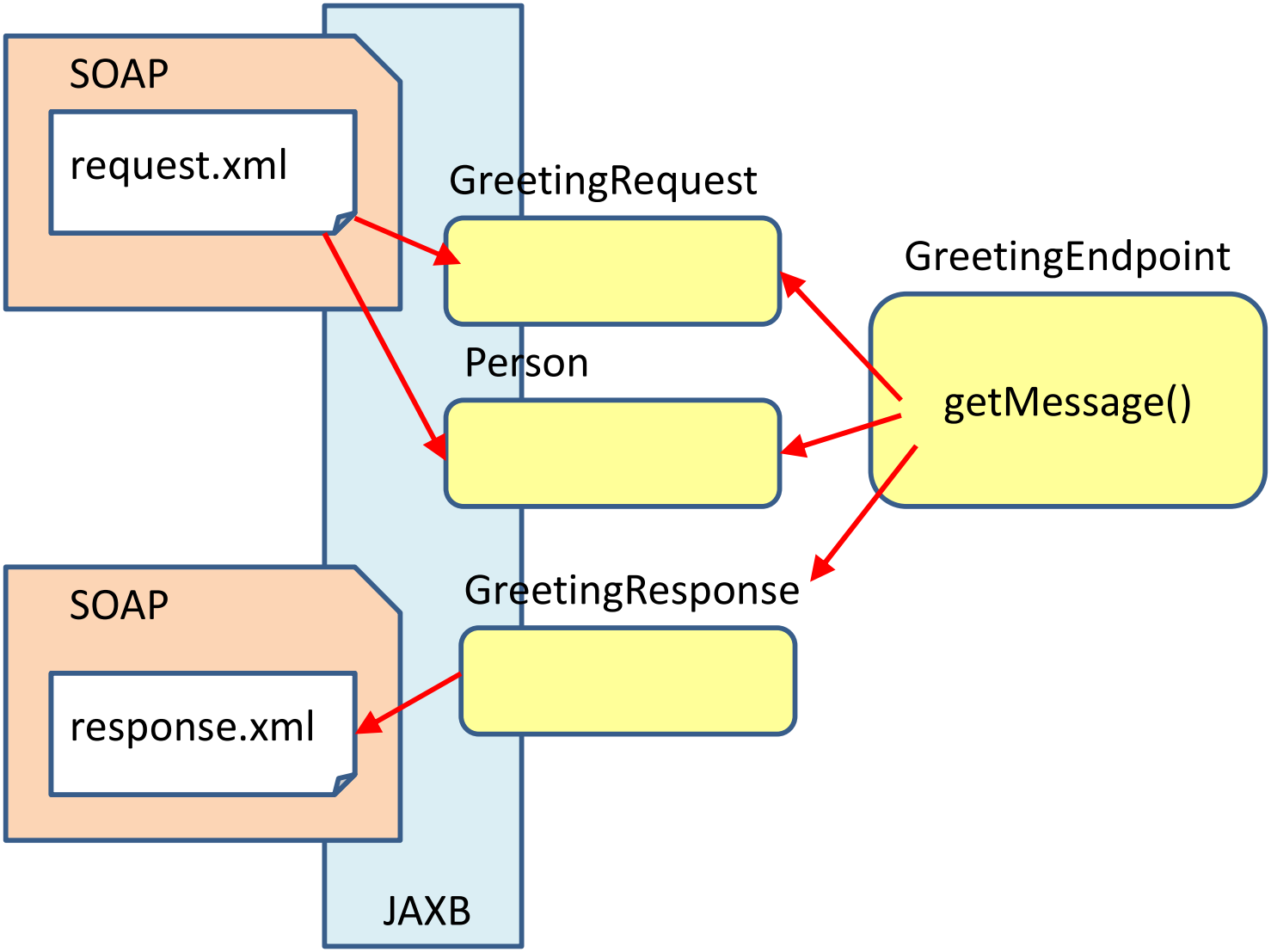
```java
@XmlAccessorType(XmlAccessType.FIELD)
@XmlType(name = "", propOrder = {
    "person"
})
@XmlRootElement(name = "GreetingRequest")
public class GreetingRequest {

    @XmlElement(name = "Person", required = true)
    protected Person person;
   ...
}
```

```java
@XmlAccessorType(XmlAccessType.FIELD)
@XmlType(name = "", propOrder = {
    "greeting"
})
@XmlRootElement(name = "GreetingResponse")
public class GreetingResponse {

    @XmlElement(name = "Greeting", required = true)
    protected String greeting;
   ...
}
```

```java
@XmlAccessorType(XmlAccessType.FIELD)
@XmlType(name = "Person", propOrder = {
    "firstName",
    "lastName"
})
public class Person {

    @XmlElement(name = "FirstName", required = true)
    protected String firstName;
    @XmlElement(name = "LastName", required = true)
    protected String lastName;
   ...
}
```

JAXB ann

Spring-WS service



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GreetingEndpoint Implementation

@Endpoint

Namespace

```
@Endpoint
public class GreetingEndpoint {
  private static final String NAMESPACE_URI = "http://springtraining/greeting";

  @PayloadRoot(namespace = NAMESPACE_URI, localPart = "GreetingRequest")
  @ResponsePayload
  public GreetingResponse getGreeting(@RequestPayload GreetingRequest request) {
    GreetingResponse response = new GreetingResponse();
    response.setGreeting("Hello "+ request.getPerson().getFirstName()+" "+
             request.getPerson().getLastName());
    return response;
  }
}
```

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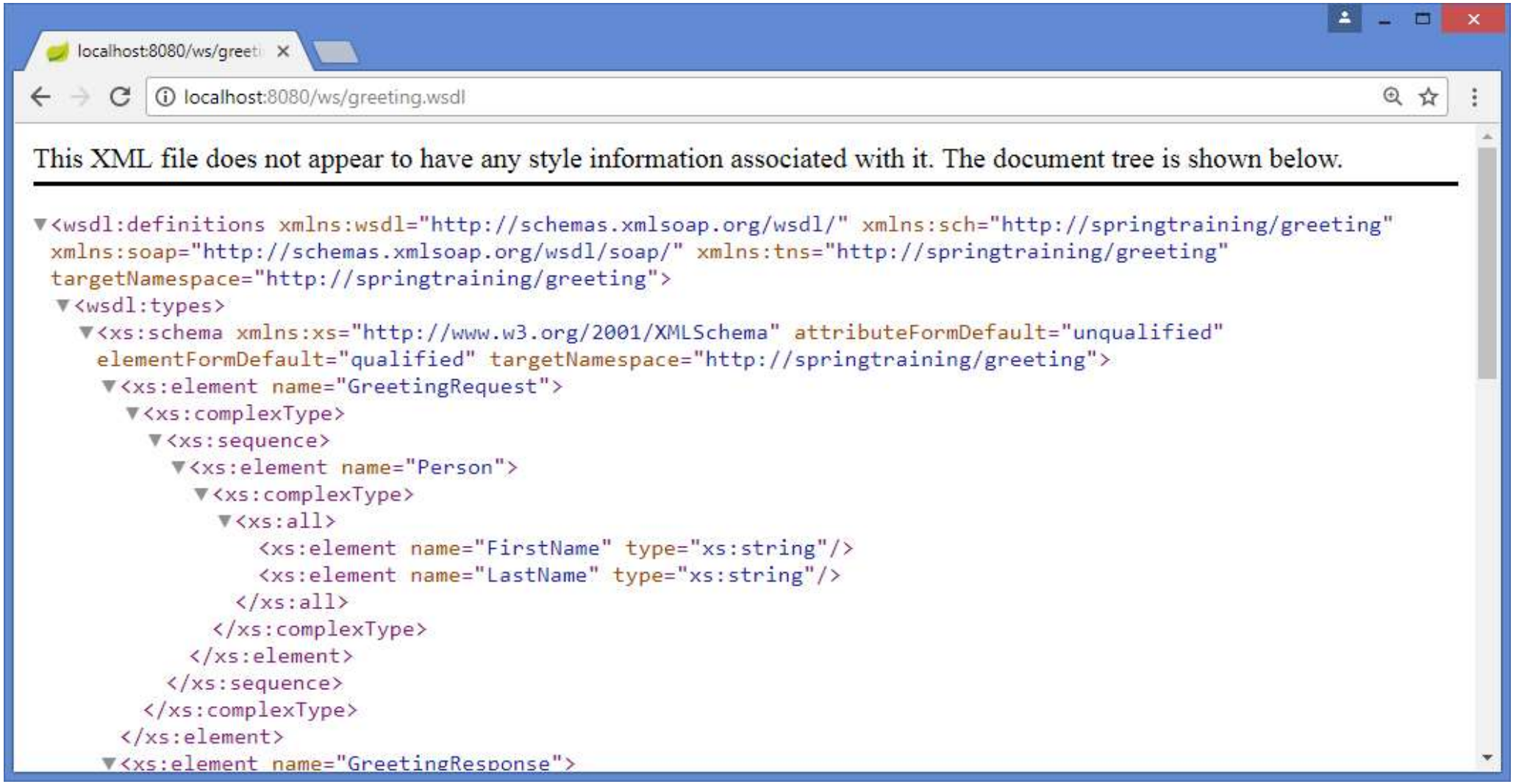
Service configuration

```
@EnableWs
@Configuration
public class WebServiceConfig extends WsConfigurerAdapter {
  @Bean
  public ServletRegistrationBean messageDispatcherServlet(ApplicationContext
                                                          applicationContext) {
    MessageDispatcherServlet servlet = new MessageDispatcherServlet();
    servlet.setApplicationContext(applicationContext);
    servlet.setTransformWsdlLocations(true);
    return new ServletRegistrationBean(servlet, "/ws/*");
  }
  @Bean(name = "greeting")
  public DefaultWsdl11Definition defaultWsdl11Definition(XsdSchema
                                                         greetingSchema) {
    DefaultWsdl11Definition wsdl11Definition = new DefaultWsdl11Definition();
    wsdl11Definition.setPortTypeName("GreetingPort");
    wsdl11Definition.setLocationUri("/ws");
    wsdl11Definition.setTargetNamespace("http://springtraining/greeting");
    wsdl11Definition.setSchema(greetingSchema);
    return wsdl11Definition;
  }
  @Bean
  public XsdSchema greetingSchema() {
    return new SimpleXsdSchema(new ClassPathResource("xsds/greeting.xsd"));
  }
}
```

Namespace

Get the WSDL


localhost:8080/ws/greeti
localhost:8080/ws/greeting.wsdl
This XML file does not appear to have any style information associated with it. The document tree is shown below.
<wsdl:definitions xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/" xmlns:sch="http://springtraining/greeting"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:tns="http://springtraining/greeting"
targetNamespace="http://springtraining/greeting">
<wsdl:types>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" attributeFormDefault="unqualified"
elementFormDefault="qualified" targetNamespace="http://springtraining/greeting">
<xs:element name="GreetingRequest">
<xs:complexType>
<xs:sequence>
<xs:element name="Person">
<xs:complexType>
<xs:all>
<xs:element name="FirstName" type="xs:string"/>
<xs:element name="LastName" type="xs:string"/>
</xs:all>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="GreetingResponse">

Test the webservice

```xml
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:gre="http://springtraining/greeting">
   <soapenv:Header/>
   <soapenv:Body>
      <gre:GreetingRequest>
         <gre:Person>
            <gre:FirstName>Frank</gre:FirstName>
            <gre:LastName>Brown</gre:LastName>
         </gre:Person>
      </gre:GreetingRequest>
   </soapenv:Body>
</soapenv:Envelope>
```

```xml
<SOAP-ENV:Envelope xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
   <SOAP-ENV:Header/>
   <SOAP-ENV:Body>
      <ns2:GreetingResponse xmlns:ns2="http://springtraining/greeting">
         <ns2:Greeting>Hello Frank Brown</ns2:Greeting>
      </ns2:GreetingResponse>
   </SOAP-ENV:Body>
</SOAP-ENV:Envelope>
```

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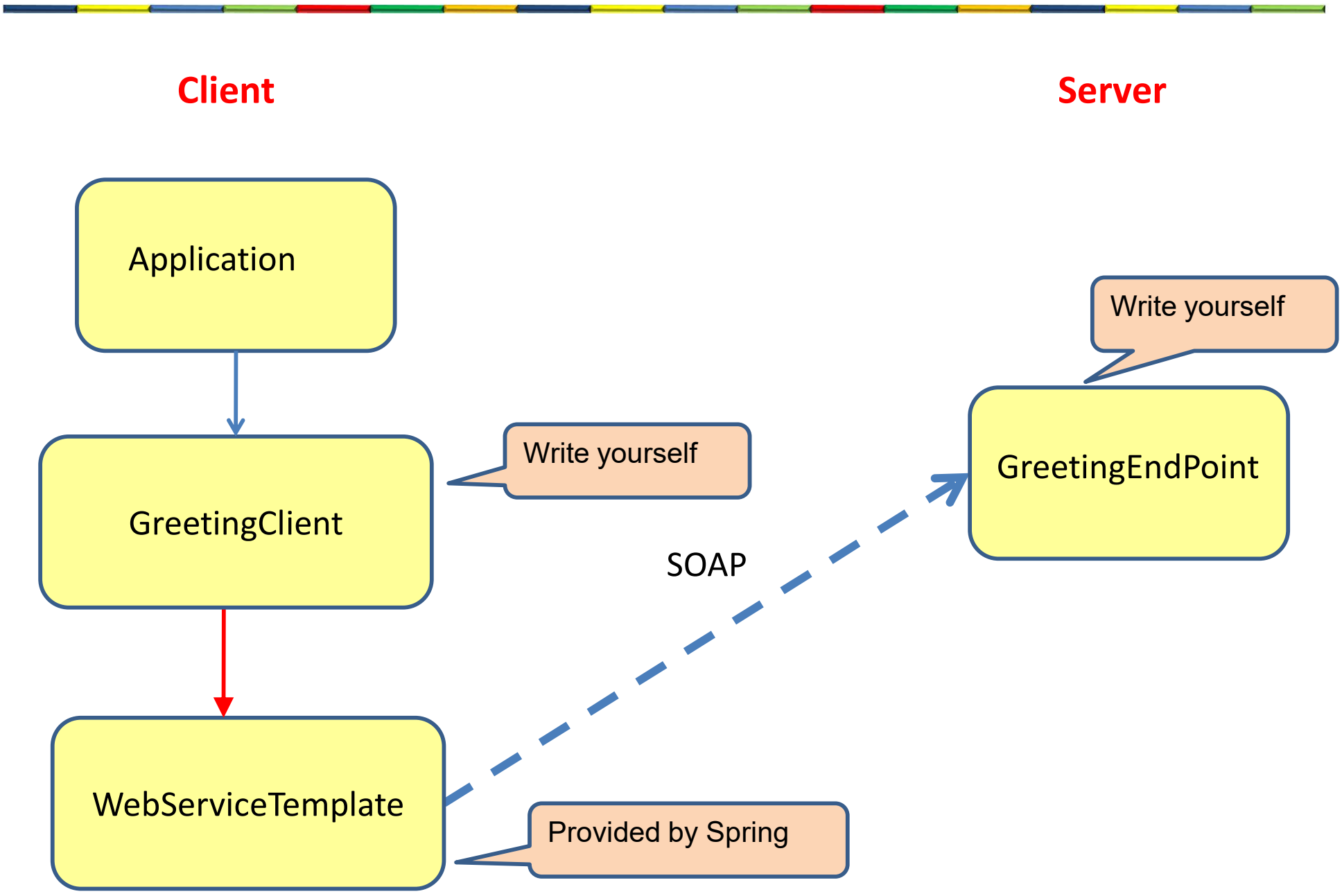
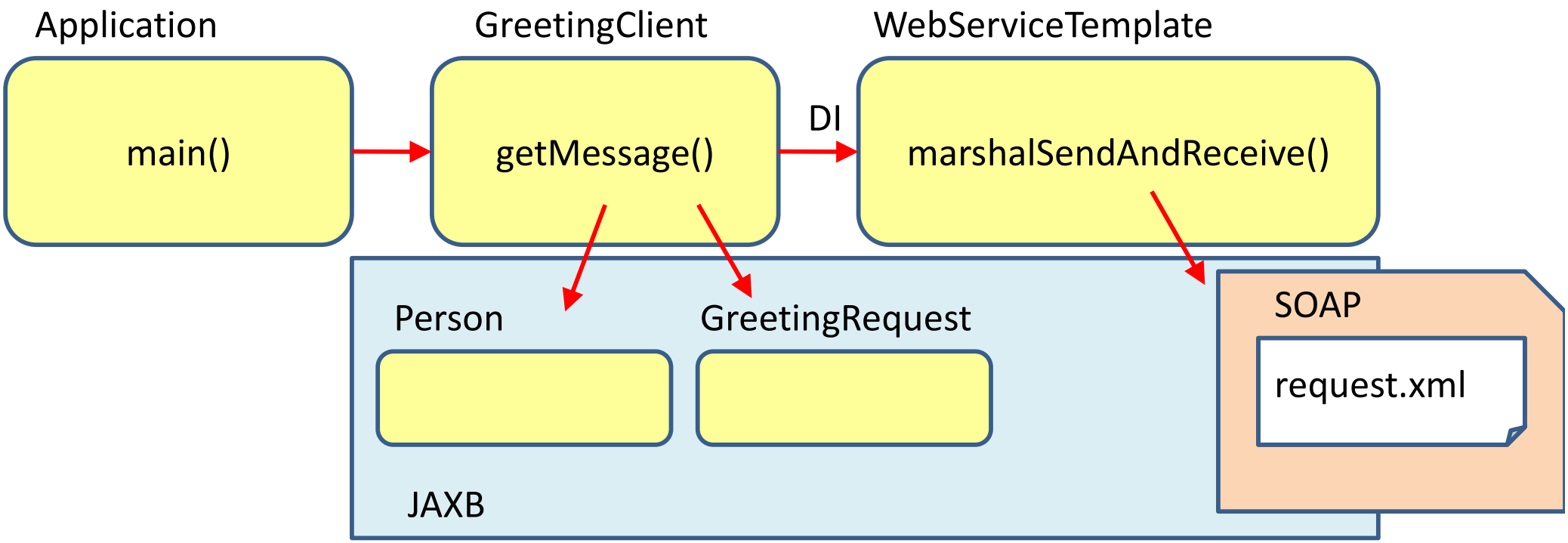
Spring WS


Client
Server
Application
GreetingClient
Write yourself
WebServiceTemplate
Provided by Spring
SOAP
Write yourself
GreetingEndPoint

Spring-WS client



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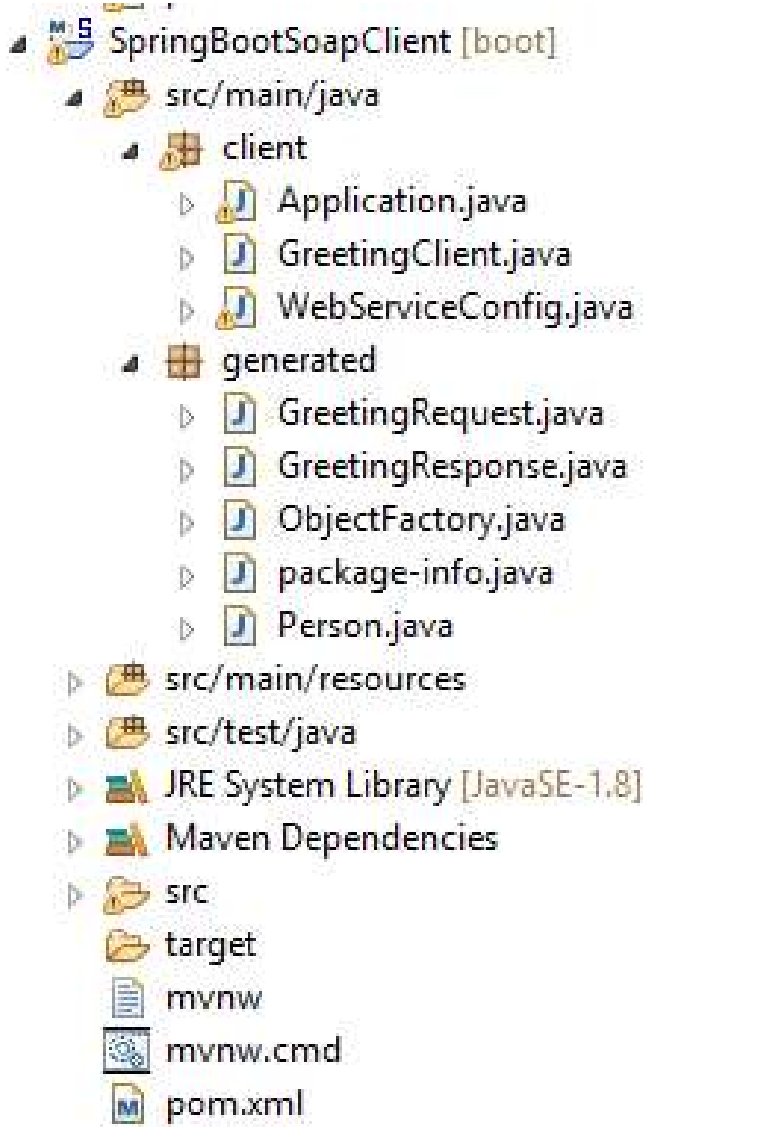
Spring-WS client



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Spring WS Client

```
public class GreetingClient extends WebServiceGatewaySupport {

  public String getMessage(Person person) {
    GreetingRequest request = new GreetingRequest();
    request.setPerson(person);

    GreetingResponse response = (GreetingResponse)
    getWebServiceTemplate().marshalSendAndReceive(request);
    return response.getGreeting();
  }
}
```

```
@SpringBootApplication
public class Application {

  public static void main(String[] args) {
    AnnotationConfigApplicationContext context =
              new AnnotationConfigApplicationContext(Application.class);
    GreetingClient greetingClient = context.getBean(GreetingClient.class);
    Person person = new Person();
    person.setFirstName("Frank");
    person.setLastName("Brown");
    System.out.println(greetingClient.getMessage(person));
  }
}
```

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Client configuration

```
@Configuration
public class WebServiceConfig {
  @Bean
  public Jaxb2Marshaller marshaller() {
    Jaxb2Marshaller marshaller = new Jaxb2Marshaller();
    // this package must match the package in the <generatePackage> specified in
    // pom.xml
    marshaller.setContextPath("generated");
return marshaller;
}

@Bean
  public GreetingClient greetingClient(Jaxb2Marshaller marshaller) {
    GreetingClient client = new GreetingClient();
    client.setDefaultUri("http://localhost:8080/ws/greeting");
    client.setMarshaller(marshaller);
    client.setUnmarshaller(marshaller);
    return client;
  }
}
```

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