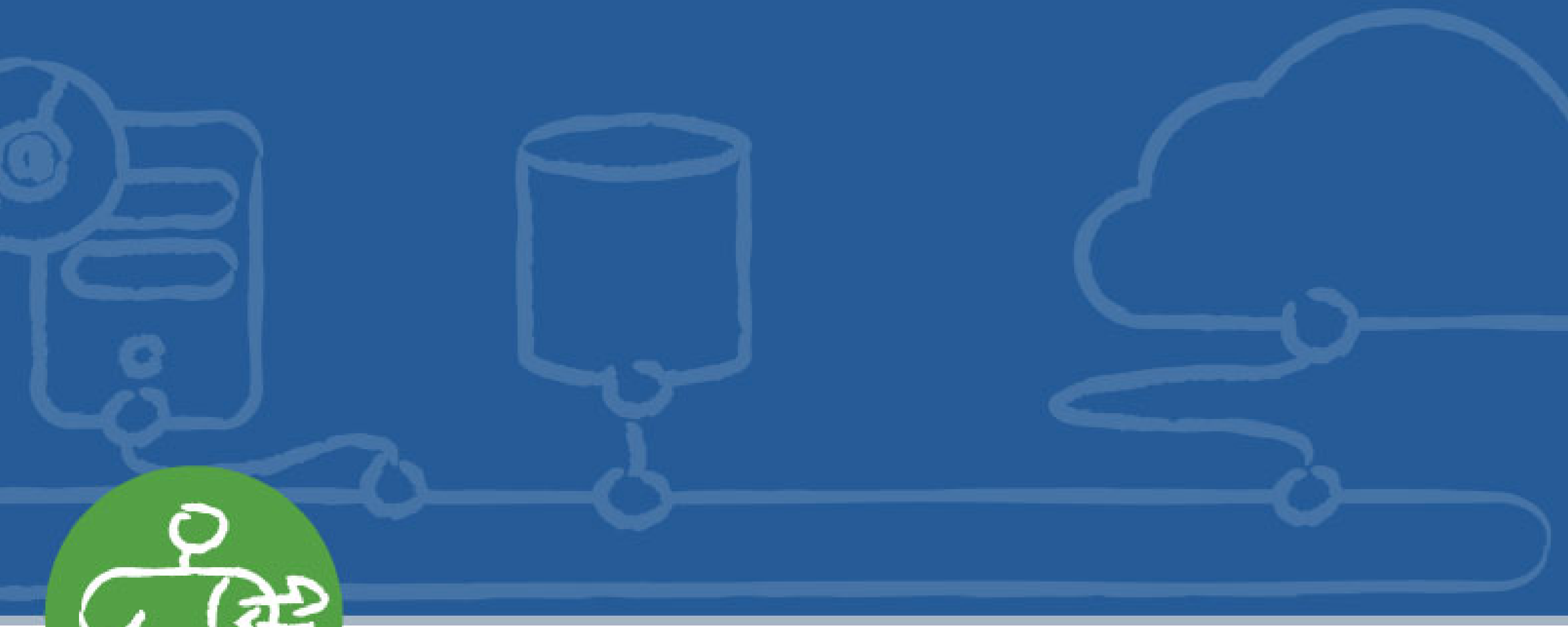

Talend ESB

Development Guide

5.2.1

Publication date 12 November 2012

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Notices

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Chapter 1. Development Environment Setup

Welcome to Talend ESB! This document looks at best practices in developing with Talend ESB, in particular using Eclipse and Maven as development tools. While development with the Eclipse IDE is covered within this guide, note the Eclipse-based Talend ESB Studio can also be used instead, as it already includes the development components we'll be configuring below.

Different types of web services (JAX-WS and JAX-RS based) will be covered in Chapter 2, *Web Services*, and then we'll explore Camel development in Chapter 3, *Camel Routes Overview*. Finally, developing with Talend ESB specific services such as Service Activity Monitoring and the Service Locator is covered in Chapter 4, *Talend ESB Services Overview*.

In this chapter we'll look in detail at installing our Eclipse development environment along with associated tools for development of web services and Camel routes. Note, if you're already working with the pre-configured Talend ESB Studio this process can be skipped.

The following sections in this chapter give details of the software needed.

1.1. Download Java Development Kit (JDK)

Either Java SE versions 6 or 7 are acceptable and can be obtained from: http://www.oracle.com/technetwork/java/javase/downloads/index.html. As we'll be compiling source files, be sure to download the JDK and not the JRE version.

1.2. Download Eclipse IDE for Java EE Developers

From the Eclipse download page obtain your operating system's version of Eclipse IDE for Java EE Developers. Juno is the most recent Eclipse version as the time of this writing, but if you already have the previous Helios or

Indigo versions of Eclipse on your machine that should work fine as well. After extracting the application, double-clicking the Eclipse icon located in the Eclipse root directory should bring up the IDE; note your specific operating system's version may provide additional convenient options (menu items, desktop icons) for activating Eclipse.

After installing, have Eclipse point to the JDK you downloaded in the previous step. This can be done by selecting menu item: Windows | Preferences and the corresponding Preferences Dialog, selecting Java | Installed JREs from the left-side menu tree.

1.3. Download Tomcat 7.x (optional)

This guide will show you how to deploy CXF services and Camel routes using Talend ESB's Karaf-based Container. However for testing and debugging it can be helpful to aware of how to deploy on the servlet container Apache Tomcat. Steps involved to deploy a Tomcat installation on your computer:

- Download and uncompress the latest Tomcat release version from the Apache Tomcat site.
- Create a $CATALINA_HOME operating system environment variable pointing to the base directory of Tomcat, and add the $CATALINA_HOME/bin directory to your system path so you can easily start Tomcat from any system folder.
- You'll need to edit the $CATALINA_HOME/conf/tomcat-users.xml file to create an administrative user for deploying and undeploying web applications. Define two new roles, `manager-script>` and `manager-gui` and add them to either a new user or any existing user, e.g.:

  ```
  <tomcat-users>
     <role rolename="manager-script"/>
     <role rolename="manager-gui"/>
     <user username="tomcat" password="tomcat"
        roles="manager-script,manager-gui"/>
     ...other users and roles...
  </tomcat-users>
  ```

  Of course, for a production deployment you'll want to use a username and password different from the easy-to-guess ones above.
- Next let's test your Tomcat installation. Run **`sh startup.sh`** (Linux) or **`startup.bat`** (Windows) and navigate to `http://localhost:8080` from a browser. You should see the Tomcat welcome screen indicating a successful activation. Next, shut down Tomcat by running the **`sh shutdown.sh`** or **`shutdown.bat`** commands as appropriate.

1.4. Download Maven 3

Maven is a very popular project management tool that can be run either from a command-line window using simple text commands or directly from the Eclipse IDE itself, using the Maven2Eclipse (m2e) plugin. The Maven Users Center provides a nice overview of working with this tool. Installation steps:

- Download and uncompress the latest Maven release version from the Apache Maven site.
- Create a $MAVEN_HOME operating system environment variable pointing to the base directory of Maven, and add the $MAVEN_HOME/bin directory to your system path so you can easily execute Maven commands from any command-line directory.
- Add the M2_REPO classpath variable to your Eclipse IDE. Maven downloads source code JARs needed by your projects to your computer, storing them in what is called your local Maven repository, normally the hidden `.m2\repository` folder in your home directory (i.e., under `/home/myusername` for Linux or `C:`

`\Documents and Settings\myusername` on Windows). Eclipse needs to know this location to load dependencies. To add this variable, start Eclipse, and from the menu bar, select Window | Preferences | Java | Build Path | Classpath Variables and define an M2_REPO variable pointing to your local repository folder.

- If you installed Tomcat in the previous step, you'll want to edit the $MAVEN_HOME/conf/settings.xml file to add in the Tomcat username and password you configured above, i.e.:

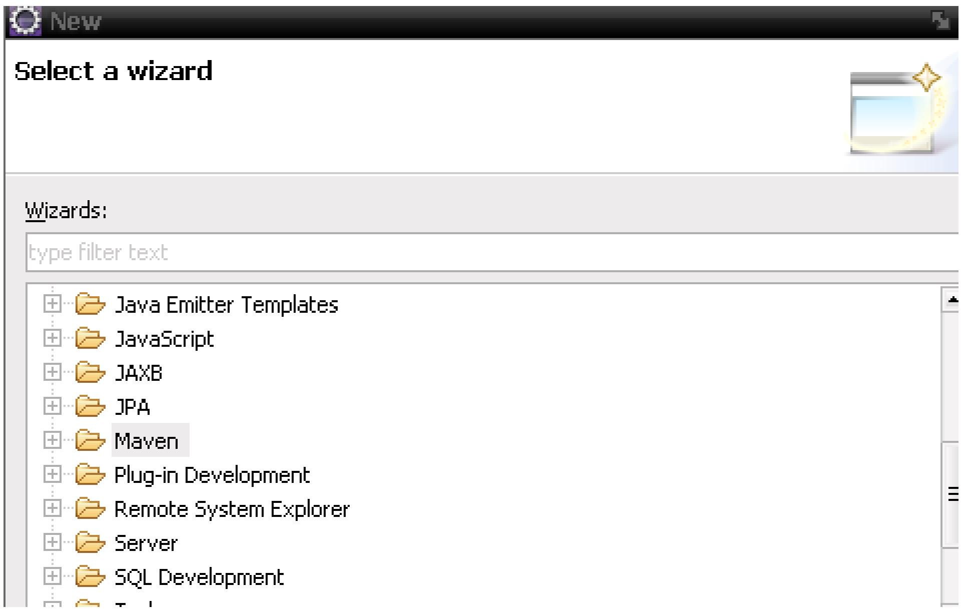
```
<servers>
   <server>
      <id>myTomcat</id>
      <username>tomcat</username>
      <password>tomcat</password>
   </server>
   ... other server configurations ...
</servers>
```

The `myTomcat` ID above (any other ID can also be used) is used within Maven pom.xml files to identify the specific server username/password combination when deploying applications to various application servers, in this case Tomcat. As an alternative, this information can be directly configured within each Maven project's pom.xml file whenever you will be doing Tomcat deployment.

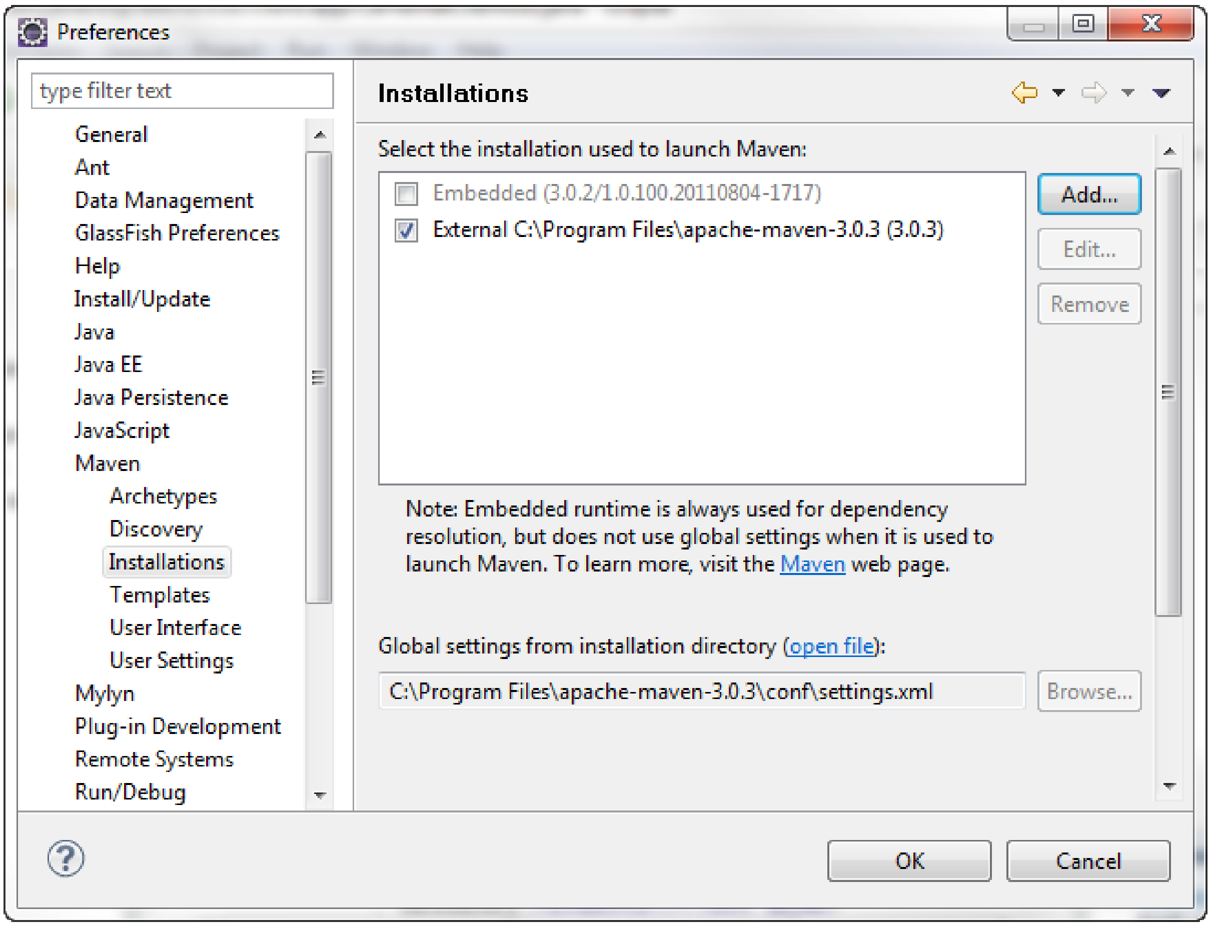
- Next let's test your Maven installation. Run **`mvn version`** from any command-line prompt. You should see Maven respond providing the Maven version you downloaded, the JDK version, and various other associated information.

1.5. Install Maven2Eclipse (m2e) Plugin (optional)

Maven commands such as **`mvn clean install`** (to build projects) and **`mvn eclipse:eclipse`** (to create Eclipse projects from them) can easily be run from a command line window, leaving Eclipse just for software code editing. However, many prefer running Maven commands in a graphical fashion within Eclipse for which the m2e plugin was created. Talend ESB Studio already includes this plugin. Otherwise, for your own Eclipse IDE, an easy way to install m2e is using the Eclipse Marketplace, available from the Eclipse menu item "Help | Eclipse Marketplace..." option after you start the IDE. Once the Marketplace popup window appears, search on "m2e" and select "Maven Integration for Eclipse". Then choose install and restart your IDE. m2e will now be available and can be seen by selecting "File->New->Other":



By default Eclipse's embedded Maven is used. However, it's recommended to use the external Maven you downloaded and installed in the previous step. Open Main Menu "Window -> Preferences -> Maven -> Installations" to change the default setting:



Installations

Select the installation used to launch Maven:

☐ Embedded (3.0.2/1.0.100.20110804-1717)
☑ External C:\Program Files\apache-maven-3.0.3 (3.0.3)

Note: Embedded runtime is always used for dependency resolution, but does not use global settings when it is used to launch Maven. To learn more, visit the Maven web page.

Global settings from installation directory (open file):

C:\Program Files\apache-maven-3.0.3\conf\settings.xml

Click Add, specify the path of where you installed Maven, and click Ok

1.6. Install soapUI Plugin (optional)

The soapUI SOAP/REST request/response tool provides an Eclipse plugin for convenient usage of this tool from the IDE. Talend ESB Studio already includes this plugin by default. If you're instead using a standard Eclipse download, see the soapUI plugin page for instructions on how to install this tool into your IDE. You may alternatively find it preferable to run the standalone version of soapUI outside of Eclipse, either their free Open Source version (fine for the purposes of this guide) or their enhanced commercial soapUI Pro product.

Chapter 2. Web Services

Talend ESB helps you to create new web services or to service-enable your existing applications and interfaces for use with the Web, using technologies based on Apache CXF. CXF supports all important web services standards including the following specifications:

- the Java API for XML Web Services (JAX-WS)
- the Java API for RESTful Web Services (REST)

JAX-WS defines annotations that allow you to define how your standalone Java application should be represented in a web services context.

There are three main styles of web services development available with CXF:

1. Contract-first development:

   Another JAX-WS option, this time a WSDL (Web Services Description Language) file is used to define the operations and types a web service provides. This file is often referred to as the web services contract, and in order to communicate with a web service, you must satisfy the contract. Contract-first development involves starting out by writing a WSDL file (either by hand or with the help of tooling), and then generating stub Java class implementations from the WSDL file by using tools such as those provided by CXF.

2. Code-first development:

   Used in JAX-WS development, here we start out with a Java class and then let the web service framework handle the job of generating a WSDL contract for you. This method is somewhat easier for newcomers to web services, as it avoids the need to construct a WSDL, however as you start to add security policies to your web services you'll probably find direct modification of an existing WSDL contract easier. Note you can also start with code to generate a WSDL and then modify that WSDL using the contract-first approach, see this article for more details.

3. JAX-RS (REST) services:

   REST is a more recent paradigm for simpler HTTP-based services which takes advantage of HTTP verbs (GET, POST, PUT, DELETE), an intuitively designed http URL string, and (in some cases) HTTP message body for responses and requests. It's paradigm is so simple that frequently usage of a web browser alone is sufficient to make and receive REST calls, however REST is not yet up to the level of providing the advanced WS-* support (security and reliability) available with JAX-WS.

We look at how to do development using these models in Section 2.1, "*Contract-first development*", Section 2.2, "*Code-first development*" and Section 2.3, "*REST Services*".

A general flowchart would be to:

1. Determine the type of web service you're interested in developing (SOAP or REST).
2. If SOAP, choose whether code-first or contract-first.
3. Determine the deployment environment (servlet container or OSGi).

Also note the Eclipse-based Talend ESB Studio provides additional graphical options, such as a RouteBuilder, if less programmatic methods of service development are desired.

2.1. Contract-first development

In this section we'll work through the `dev-guide-wsdl-first` example available in the Talend ESB download, in the `examples/cxf` folder. This sample web service provides a simple SOAP operation called "DoubleIt", which takes an integer in the SOAP request and provides a doubled number in the response. Both Tomcat and Talend ESB deployment options are shown below.

2.1.1. Project Structure

This sample is Maven-based and consists of three Maven submodules tied together with a parent pom.xml (Maven configuration) file located in the base directory. (The next section will cover the POM files in detail.) The purpose of each of the submodules are as follows:

Submodule	**Description**
service	Provides the implementation for the web service provider (WSP) including its WSDL and OSGi deployment configuration (the latter ignored with Tomcat deployment.) Used both by the war submodule for servlet (Tomcat) deployment and as an OSGi bundle for the Talend OSGi container. This submodule also generates a separate bundle holding the JAX-WS artifacts (WSP service interfaces and JAXB databinding classes) that will be used by the SOAP client.
war	Generates a deployable WAR containing the WSP that can be used with servlet containers such as Tomcat or Jetty. Consists mainly of the web.xml and servlet-specific WSP deployment configuration files. The Talend OSGi container does not use this module.
client	Provides a sample SOAP client for making calls against the WSP. After the WSP is deployed (either via servlet or OSGi), this client can be activated simply by navigating to this folder from a command-prompt window and running **`mvn exec:exec`**.

In this section, let's build the project and import it into the Eclipse IDE (the latter step optional, as source files can be viewed and modified using any text editor):

1. **Build the project**

   From a command-prompt window, navigate to the `examples/cxf/dev-guide-wsdl-first` folder and run **`mvn clean install`**. You should see a success message similar to:

```
[INFO] ----------------------------------------------------------------
[INFO] Reactor Summary:
[INFO]
[INFO] Dev Guide Tutorial: WSDL-First Web Service .... SUCCESS [0.197s]
[INFO] -- Web Service Provider ....................... SUCCESS [4.246s]
[INFO] -- Service WAR file ........................... SUCCESS [1.143s]
[INFO] -- SOAP Client ................................ SUCCESS [0.692s]
[INFO] ----------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ----------------------------------------------------------------
[INFO] Total time: 6.986s
```

2. **Import the project into Eclipse**

   We're importing the project into Eclipse to better view and edit the project's source files, not for building and compiling the project--that's still handled by Maven, allowing you to use any IDE for development.

   From the `dev-guide-wsdl-first` folder run **`mvn eclipse:clean eclipse:eclipse`**. Here, the Maven Eclipse Plugin will create the Eclipse project folders allowing for easy importation of the project into the IDE.

   Next, within Eclipse import the three projects into the IDE using File Menu->Import->Existing Projects Into Workspace and selecting the `dev-guide-wsdl-first` root folder. You'll see the three Maven subprojects (client, service, war) that you can bring in. Note as just the submodules are being imported that the top-level `dev-guide-wsdl-first/pom.xml` file will not be directly accessible from the IDE using this method--you'll need to manually open this file when desired from the Eclipse File menu.

2.1.2. Maven POM files

This sample consists of four Maven pom.xml files--the top-level pom.xml and one pom.xml file for each of the three submodules. Because they specify the top-level pom as their parent, the latter three all inherit the configuration information in the top-level pom.xml file. Also, because the top-level pom explicitly references each of this submodules, those submodules are processed while running most Maven commands (such as `mvn clean install` or `mvn eclipse:eclipse`) from the project base directory. We'll explore this project's pom.xml files in this section.

2.1.2.1. Top-level pom.xml

This is the parent pom file declaring common dependencies and plugins used by the submodules (service, war, and client).

```
<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/maven-v4_0_0.xsd">

    <modelVersion>4.0.0</modelVersion>
    <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
    <artifactId>dev-guide-wsdl-first</artifactId>
    <version>1.0-SNAPSHOT</version>
    <name>Dev Guide Tutorial: WSDL-First Web Service</name>
    <packaging>pom</packaging>

    <modules>
        <module>service</module>
        <module>war</module>
        <module>client</module>
    </modules>

    <properties>
        <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
        <cxf.version>2.7.0</cxf.version>
        <spring.version>3.0.7.RELEASE</spring.version>
    </properties>
    <build>
        <plugins>
            <plugin>
                <groupId>org.apache.maven.plugins</groupId>
                <artifactId>maven-compiler-plugin</artifactId>
                <version>2.3.2</version>
                <configuration>
                    <source>1.6</source>
                    <target>1.6</target>
                </configuration>
            </plugin>
            <plugin>
                <groupId>org.apache.maven.plugins</groupId>
                <artifactId>maven-eclipse-plugin</artifactId>
                <version>2.8</version>
                <configuration>
                    <downloadSources>true</downloadSources>
                </configuration>
            </plugin>
        </plugins>
    </build>

    <dependencies>
        <dependency>
            <groupId>org.apache.cxf</groupId>
            <artifactId>cxf-rt-frontend-jaxws</artifactId>
            <version>${cxf.version}</version>
        </dependency>
        <dependency>
            <groupId>org.apache.cxf</groupId>
            <artifactId>cxf-rt-transports-http</artifactId>
            <version>${cxf.version}</version>
        </dependency>
    </dependencies>

</project>
```

2.1.2.2. service/pom.xml

This pom file generates the JAX-WS artifacts using CXF's wsdl2java utility that will be used by the web service provider and the SOAP client. The Maven Assembly Plugin is used here to create an additional JAR artifact containing just the JAX-WS objects, which will be later included as a dependency in the client's pom.xml file. JUnit is included for unit testing, which will be shown shortly. The packaging element has a value of "bundle" which will work for both OSGi and servlet deployment, for servlet-only deployment the (very) slightly simpler "jar" value can be used instead.

```
<project xmlns="http://maven.apache.org/POM/4.0.0" ...

    <modelVersion>4.0.0</modelVersion>
    <artifactId>dev-guide-wsdl-first-service</artifactId>
    <name>-- Web Service Provider</name>
    <packaging>bundle</packaging>

    <parent>
        <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
        <artifactId>dev-guide-wsdl-first</artifactId>
        <version>1.0-SNAPSHOT</version>
    </parent>

    <dependencies>
        <dependency>
            <groupId>junit</groupId>
            <artifactId>junit</artifactId>
            <version>4.10</version>
            <scope>test</scope>
        </dependency>
    </dependencies>

    <build>
        <plugins>
            <!-- Below plugin provides a separate JAR for the JAX-WS artifacts
                (i.e., the objects created by running wsdl2java or wsimport),
                as this JAR will also be used by the SOAP client.
                More info: http://maven.apache.org/plugins/maven-assembly-plugin/
            -->
            <plugin>
                <artifactId>maven-assembly-plugin</artifactId>
                <version>2.2.1</version>
                <configuration>
                    <descriptors>
                        <descriptor>src/assembly/jaxws-jar.xml</descriptor>
                    </descriptors>
                    <appendAssemblyId>true</appendAssemblyId>
                    <attach>true</attach>
                </configuration>
                <executions>
                    <execution>
                        <id>make-assembly</id>
                        <phase>package</phase>
                        <goals>
                            <goal>single</goal>
                        </goals>
                    </execution>
                </executions>
            </plugin>
            <plugin>
                <groupId>org.apache.cxf</groupId>
                <artifactId>cxf-codegen-plugin</artifactId>
                <version>${cxf.version}</version>
                <executions>
                    <execution>
                        <configuration>
                            <sourceRoot>
                                ${basedir}/target/generated-sources
                            </sourceRoot>
                            <wsdlOptions>
                                <wsdlOption>
                                    <wsdl>
                                        ${basedir}/src/main/resources/DoubleIt.wsdl
                                    </wsdl>
                                    <wsdlLocation>
                                        classpath:DoubleIt.wsdl
                                    </wsdlLocation>
                                </wsdlOption>
                            </wsdlOptions>
                        </configuration>
                        <goals>
                            <goal>wsdl2java</goal>
                        </goals>
                    </execution>
                </executions>
            </plugin>
            <plugin>
                <groupId>org.apache.felix</groupId>
                <artifactId>maven-bundle-plugin</artifactId>
                <version>2.3.5</version>
                <extensions>true</extensions>
                <configuration>
                    <instructions>
                        <Bundle-SymbolicName>
                            ${project.artifactId}
                        </Bundle-SymbolicName>
                        <Require-Bundle>
                            org.apache.cxf.bundle,org.springframework.beans
                        </Require-Bundle>
                        <Export-Package>service</Export-Package>
                    </instructions>
                </configuration>
            </plugin>
        </plugins>
        <!-- Name of the generated WAR file -->
        <finalName>doubleit</finalName>
    </build>

</project>
```

2.1.2.3. war/pom.xml

This pom creates the WAR file that will host the web service if you're using Tomcat. It is not needed for OSGi deployment, but if you omit adding this file be sure to remove this module from the module list in the parent pom.xml.

```
<project xmlns="http://maven.apache.org/POM/4.0.0" ...

    <modelVersion>4.0.0</modelVersion>
    <artifactId>dev-guide-wsdl-first-war</artifactId>
    <name>-- Service WAR file</name>
    <packaging>war</packaging>

    <parent>
        <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
        <artifactId>dev-guide-wsdl-first</artifactId>
        <version>1.0-SNAPSHOT</version>
    </parent>

    <dependencies>
        <dependency>
            <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
            <artifactId>dev-guide-wsdl-first-service</artifactId>
            <version>1.0-SNAPSHOT</version>
        </dependency>
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-web</artifactId>
            <version>${spring.version}</version>
        </dependency>
    </dependencies>

    <build>
        <plugins>
            <plugin>
                <groupId>org.codehaus.mojo</groupId>
                <artifactId>tomcat-maven-plugin</artifactId>
                <version>1.1</version>
                <configuration>
                    <server>myTomcat</server>
                    <url>http://localhost:8080/manager/text</url>
                    <path>/${project.build.finalName}</path>
                </configuration>
            </plugin>
            <plugin>
                <artifactId>maven-war-plugin</artifactId>
                <version>2.1.1</version>
                <configuration>
                    <webXml>src/main/webapp/WEB-INF/web.xml</webXml>
                    <webResources>
                        <resource>
                            <directory>../service/src/main/resources</directory>
                            <targetPath>WEB-INF/wsdl</targetPath>
                            <includes>
                                <include>*.wsdl</include>
                            </includes>
                        </resource>
                    </webResources>
                </configuration>
            </plugin>
        </plugins>
        <!-- Name of the generated WAR file -->
        <finalName>doubleit</finalName>
    </build>

</project>
```

2.1.2.4. client/pom.xml

This pom file includes as a dependency the JAX-WS artifact jar created above and uses the Maven Exec Plugin to activate the SOAP client.

```
<?xml version="1.0" encoding="UTF-8"?>
<project xmlns="http://maven.apache.org/POM/4.0.0" ...

    <modelVersion>4.0.0</modelVersion>
    <artifactId>dev-guide-wsdl-first-client</artifactId>
    <name>-- SOAP Client</name>
    <packaging>jar</packaging>

    <parent>
        <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
        <artifactId>dev-guide-wsdl-first</artifactId>
        <version>1.0-SNAPSHOT</version>
    </parent>

    <dependencies>
        <dependency>
            <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
            <artifactId>dev-guide-wsdl-first-service</artifactId>
            <!-- Classifier below used with Maven Assembly Plugin to specify
                subset of above artifact needed. -->
            <classifier>jaxws</classifier>
            <version>1.0-SNAPSHOT</version>
        </dependency>
    </dependencies>

    <build>
        <plugins>
            <plugin>
                <groupId>org.codehaus.mojo</groupId>
                <artifactId>exec-maven-plugin</artifactId>
                <version>1.2</version>
                <executions>
                    <execution>
                        <goals>
                            <goal>exec</goal>
                        </goals>
                    </execution>
                </executions>
                <configuration>
                    <executable>java</executable>
                    <arguments>
                        <argument>-classpath</argument>
                        <classpath />
                        <argument>
                            client.WSClient
                        </argument>
                    </arguments>
                </configuration>
            </plugin>
        </plugins>
    </build>
</project>
```

2.1.3. Creating the WSDL

The below WSDL defines a single operation, `doubleit` supported by this web service endpoint. The soap:address location below is used by the SOAP client but ignored by the web service provider. The WSP generates the endpoint address based on the deployment configuration information below and will update the soap:address value when viewing the WSDL from a browser. Here, we're configuring the `soap:address` value to what it will be using the configuration information in the next steps. It's presently configured to the address for Talend ESB OSGi deployment, but for Tomcat deployment will need to be changed to `http://localhost:8080/doubleit/services/doubleit` due to the different default endpoint location for servlet-hosted services.

```
<?xml version="1.0" encoding="UTF-8"?>
<wsdl:definitions name="DoubleIt"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
    xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    xmlns:di="http://www.example.org/schema/DoubleIt"
    xmlns:tns="http://www.example.org/contract/DoubleIt"
    targetNamespace="http://www.example.org/contract/DoubleIt">
    <wsdl:types>
        <xsd:schema targetNamespace="http://www.example.org/schema/DoubleIt">
            <xsd:element name="DoubleIt">
                <xsd:complexType>
                    <xsd:sequence>
```

```
                        <xsd:element name="numberToDouble"
                            type="xsd:int" />
                    </xsd:sequence>
                </xsd:complexType>
            </xsd:element>
            <xsd:element name="DoubleItResponse">
                <xsd:complexType>
                    <xsd:sequence>
                        <xsd:element name="doubledNumber"
                            type="xsd:int" />
                    </xsd:sequence>
                </xsd:complexType>
            </xsd:element>
        </xsd:schema>
    </wsdl:types>
    <wsdl:message name="DoubleItRequest">
        <wsdl:part element="di:DoubleIt" name="parameters" />
    </wsdl:message>
    <wsdl:message name="DoubleItResponse">
        <wsdl:part element="di:DoubleItResponse" name="parameters" />
    </wsdl:message>
    <wsdl:portType name="DoubleItPortType">
        <wsdl:operation name="DoubleIt">
            <wsdl:input message="tns:DoubleItRequest" />
            <wsdl:output message="tns:DoubleItResponse" />
        </wsdl:operation>
    </wsdl:portType>
    <wsdl:binding name="DoubleItBinding" type="tns:DoubleItPortType">
        <soap:binding style="document"
            transport="http://schemas.xmlsoap.org/soap/http" />
        <wsdl:operation name="DoubleIt">
            <soap:operation soapAction="" />
            <wsdl:input>
                <soap:body use="literal" />
            </wsdl:input>
            <wsdl:output>
                <soap:body use="literal" />
            </wsdl:output>
        </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="DoubleItService">
        <wsdl:port name="DoubleItPort" binding="tns:DoubleItBinding">
            <soap:address
                location="http://localhost:8040/services/doubleit" />
        </wsdl:port>
    </wsdl:service>
</wsdl:definitions>
```

2.1.4. Configuring Deployment Descriptors

Different configuration files are used depending on whether you're deploying to Tomcat or Talend ESB. Servlet container deployment requires a standard web.xml file as well as Spring configuration file to configure the endpoint, while Talend ESB just needs an OSGi Blueprint configuration file.

2.1.4.1. Talend ESB (OSGi)

OSGi configuration of the web service provider can be done in either two ways, using the OSGi Blueprint Specification or Spring-Dynamic Modules (DM). We'll use the more standard Blueprint here, placing this `service.xml` file in `src/main/resources/OSGI-INF/blueprint` of the service submodule. This file is ignored in the case of Tomcat deployment.

```
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:cm="http://aries.apache.org/blueprint/xmlns/blueprint-cm/v1.0.0"
    xmlns:jaxws="http://cxf.apache.org/blueprint/jaxws"
    xmlns:cxf="http://cxf.apache.org/blueprint/core"
    xsi:schemaLocation="
        http://www.osgi.org/xmlns/blueprint/v1.0.0
        http://www.osgi.org/xmlns/blueprint/v1.0.0/blueprint.xsd
        http://cxf.apache.org/blueprint/jaxws
        http://cxf.apache.org/schemas/blueprint/jaxws.xsd
        http://cxf.apache.org/blueprint/core
        http://cxf.apache.org/schemas/blueprint/core.xsd
        ">

    <jaxws:endpoint id="doubleit" implementor="service.DoubleItPortTypeImpl"
        wsdlLocation="DoubleIt.wsdl" address="/doubleit">
    </jaxws:endpoint>

</blueprint>
```

2.1.4.2. Tomcat (WAR archive)

Since the cxf-servlet.xml Spring configuration file below is used just for WAR deployment, the project has this file stored in the WAR submodule's `war/src/main/webapp/WEB-INF` folder instead of within the servlet submodule.

```
<?xml version="1.0" encoding="UTF-8"?>
<beans xmlns="http://www.springframework.org/schema/beans"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xmlns:jaxws="http://cxf.apache.org/jaxws"
      xsi:schemaLocation="
         http://www.springframework.org/schema/beans
         http://www.springframework.org/schema/beans/spring-beans.xsd
         http://cxf.apache.org/jaxws
         http://cxf.apache.org/schemas/jaxws.xsd">

    <jaxws:endpoint
        id="doubleit"
        implementor="service.DoubleItPortTypeImpl"
        wsdlLocation="WEB-INF/wsdl/DoubleIt.wsdl"
        address="/doubleit">
    </jaxws:endpoint>
</beans>
```

In the same folder, we store the web.xml file shown below for the WAR archive.

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app version="2.5" xmlns="http://java.sun.com/xml/ns/javaee"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
    http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd">
    <display-name>Sample web service provider</display-name>
    <listener>
        <listener-class>
```

```
              org.springframework.web.context.ContextLoaderListener
        </listener-class>
    </listener>
    <context-param>
        <param-name>contextConfigLocation</param-name>
        <param-value>
          classpath:META-INF/cxf/cxf.xml
        </param-value>
    </context-param>
    <servlet>
        <servlet-name>WebServicePort</servlet-name>
        <servlet-class>org.apache.cxf.transport.servlet.CXFServlet</servlet-class>
        <load-on-startup>1</load-on-startup>
    </servlet>
    <servlet-mapping>
        <servlet-name>WebServicePort</servlet-name>
        <url-pattern>/services/*</url-pattern>
    </servlet-mapping>
    <session-config>
        <session-timeout>60</session-timeout>
    </session-config>
</web-app>
```

2.1.5. Creating the Web Service Provider (WSP)

This class, kept in the service submodule's `src/main/java/service` folder, is commonly known as either the Service Implementation Bean (SIB) or the SEI (Service Endpoint Interface) implementation. The SEI is the DoubleItPortType class that was generated from the WSDL earlier. The methods in the SEI map to the operations defined in the portType section of the WSDL.

```
package service;

import javax.jws.WebService;
import org.example.contract.doubleit.DoubleItPortType;

@WebService(targetNamespace = "http://www.example.org/contract/DoubleIt",
            portName="DoubleItPort",
            serviceName="DoubleItService",
            endpointInterface="org.example.contract.doubleit.DoubleItPortType")
public class DoubleItPortTypeImpl implements DoubleItPortType {

    public int doubleIt(int numberToDouble) {
        return numberToDouble * 2;
    }
}
```

We should also create JUnit unit tests of our web service implementation in which we check before deploying the SIB that its methods are properly implemented (e.g., doubleIt is not erroneously tripling incoming numbers). Sample test cases for the SIB are placed in the same Java package as the class we're testing albeit in a different folder location (per Maven convention, `service/src/test/...` instead of `service/src/main/...`). Doing it this way reduces the need for Java import statements in the test cases while still keeping test code out of deployment JARs. The following unit test cases are included for this sample:

```
package service;

import org.junit.Test;
import static org.junit.Assert.assertEquals;

public class DoubleItPortTypeImplTest {
    @Test
    public void testDoubleItWorksWithPositiveNumbers() {
        DoubleItPortTypeImpl port = new DoubleItPortTypeImpl();
        int response = port.doubleIt(12);
        assertEquals("DoubleIt isn't working with positive numbers", 24, response);
    }

    @Test
    public void testDoubleItWorksWithZero() {
        DoubleItPortTypeImpl port = new DoubleItPortTypeImpl();
        int response = port.doubleIt(0);
        assertEquals("DoubleIt isn't doubling zero correctly", 0, response);
    }

    @Test
    public void testDoubleItWorksWithNegativeNumbers() {
        DoubleItPortTypeImpl port = new DoubleItPortTypeImpl();
        int response = port.doubleIt(-8);
        assertEquals("DoubleIt isn't working with negative numbers", -16, response);
    }
}
```

During the build process (**`mvn clean install`**) JUnit tests will be automatically detected and run before any JARs are created. If there's any failure in the test cases the build will halt, requiring you to fix the SIB prior to re-running the build process. If failures occur, check the `service/target/surefire-reports` folder that will be created for detailed test results.

Later, you may also wish to do integration testing of your web service, using actual SOAP calls against a web service activated via an embedded (internal) server. For an example, the java_first_jaxws example in the software distribution <TalendRuntimePath>/examples/apache/cxf/java_first_jaxws configures separate Maven profiles within the pom.xml, one for the service and the other for a test client. Simply running the **`mvn -Pserver`** and **`mvn -Pclient`** commands from separate terminal windows will allow you to see the results of client requests against the web service provider.

2.1.6. Deploying the WSP

This section provides two deployment options, either on Talend ESB or on Tomcat.

2.1.6.1. Talend ESB (OSGi)

During the previous build process Maven installed the application's bundles in your local Maven repository. It is from there that Talend ESB will load bundles and activate them. To deploy the web service provider on Talend ESB:

1. Start Talend ESB from the command-line, from the container/bin folder run either **`./trun`** (Linux) or **`trun.bat`** (Windows). When the container starts up, you will see a short introduction (similar to the one below) followed by the OSGi console command prompt:

```
./trun

Hit '<tab>' for a list of available commands
and '[cmd] --help' for help on a specific command.
Hit '<ctrl-d>' or 'osgi:shutdown' to shutdown the TRUN.
```

```
karaf@trun>
```

2. From the Talend ESB karaf prompt, enter: **`install mvn:org.talend.cxf-examples.dev-guide-wsdl-first/dev-guide-wsdl-first-service/5.2.1`**.

   For the above bundle, `mvn` refers to the protocol (`http://` and `file:/` are other common alternatives), while the remaining portion refers to the Maven group ID, artifact ID, and version separated by forward slashes.

   After Talend ESB reports the bundle ID, next enter **`start <bundleID>`**. Typing **`osgi:list`** afterwards from the Karaf prompt should show that the web service provider has successfully started. If any failure is indicated, check the container/data/log file for any error information. Prior to calling the client in the next step, make sure you can bring up the web service's WSDL at `http://localhost:8040/services/doubleit?wsdl`.

For more information on working with Talend ESB including its OSGi commands please see *Talend ESB Getting Started Guide* and *Talend ESB Container Administration Guide*.

2.1.6.2. Tomcat (WAR archive)

Make sure you've configured Tomcat and Maven as discussed in Section 1.3, “*Download Tomcat 7.x (optional)*” and Section 1.4, “*Download Maven 3*”, and that you've updated the soap:address element in the WSDL as discussed in Section 2.1.3, “*Creating the WSDL*”. If so, starting Tomcat and running **`mvn tomcat:redeploy`** from the project root folder should deploy the web service provider onto Tomcat. As a check to make sure the WSP has loaded successfully, make sure you can view the WSDL from a browser at `http://localhost:8080/doubleit/services/doubleit?wsdl` before running the client. If it cannot be viewed, check the Tomcat logs (`logs/catalina.out` is usually the most helpful) for error messages to help with troubleshooting.

2.1.7. Running the SOAP Client

The SOAP client is as listed below. It can be activated by navigating to the client folder and running **`mvn exec:exec`**.

```
package client;

import org.example.contract.doubleit.DoubleItPortType;
import org.example.contract.doubleit.DoubleItService;

public class WSClient {
    public static void main (String[] args) {
        DoubleItService service = new DoubleItService();
        DoubleItPortType port = service.getDoubleItPort();

        doubleIt(port, 10);
        doubleIt(port, 0);
        doubleIt(port, -10);
    }

    public static void doubleIt(DoubleItPortType port,
            int numToDouble) {
        int resp = port.doubleIt(numToDouble);
        System.out.println("The number " + numToDouble + " doubled is "
            + resp);
    }
}
```

2.2. Code-first development

Code-first development means starting from an existing Java interface of a web service provider from which a WSDL can automatically be generated. Talend ESB, in the `examples/cxf` folder, provides a `dev-guide-java-first` sample functionally equivalent to the `dev-guide-wsdl-first` example explored in the previous section. CXF's Java2ws tool, configured within the cxf-java2ws-plugin Maven plugin, is used for this process. For example, given a simple web service interface:

```
package service;

import javax.jws.WebService;
import javax.jws.WebMethod;

@WebService
public interface DoubleItPortType {
   public int doubleIt(int numberToDouble);
}
```

The code first developer will implement the web service, adding annotations to indicate desired web service configuration information:

```
package service;

import javax.jws.WebService;

@WebService(targetNamespace = "http://www.example.org/contract/DoubleIt",
            endpointInterface = "service.DoubleItPortType",
            serviceName = "DoubleItService",
            portName = "DoubleItPort")
public class DoubleItPortTypeImpl implements DoubleItPortType {

    public int doubleIt(int numberToDouble) {
        return numberToDouble * 2;
    }
}
```

If the Maven pom.xml has the cxf-java2ws-plugin configured as follows:

```
<plugin>
    <groupId>org.apache.cxf</groupId>
    <artifactId>cxf-java2ws-plugin</artifactId>
    <version>${cxf.version}</version>
    <executions>
        <execution>
            <id>process-classes</id>
            <phase>process-classes</phase>
            <configuration>
                <className>service.DoubleItPortTypeImpl</className>
                <genWsdl>true</genWsdl>
                <verbose>true</verbose>
            </configuration>
            <goals>
                <goal>java2ws</goal>
            </goals>
        </execution>
    </executions>
</plugin>
```

An autogenerated two-part WSDL supporting this web service will be created, as shown below (certain areas truncated for brevity). The first file, `DoubleItPortTypeImpl.wsdl` contains message input and output information as well as the generic `wsdl:portType` that lists the method calls available. The `wsdl:portType` value incorporates the name of the web service interface. This interface also provides (from its doubleIt method) the name of the specific operation and its parameters.

```
<wsdl:definitions name="DoubleItPortType" targetNamespace="http://service/">
    <wsdl:types>
        <xs:schema elementFormDefault="unqualified"
            targetNamespace="http://service/" version="1.0">
            <xs:element name="doubleIt" type="tns:doubleIt" />
            <xs:element name="doubleItResponse" type="tns:doubleItResponse" />
            <xs:complexType name="doubleIt">
                <xs:sequence>
                    <xs:element name="arg0" type="xs:int" />
                </xs:sequence>
            </xs:complexType>
            <xs:complexType name="doubleItResponse">
                <xs:sequence>
                    <xs:element name="return" type="xs:int" />
                </xs:sequence>
            </xs:complexType>
        </xs:schema>
    </wsdl:types>
    <wsdl:message name="doubleIt">
        <wsdl:part name="parameters" element="ns1:doubleIt"/>
    </wsdl:message>
    <wsdl:message name="doubleItResponse">
        <wsdl:part name="parameters" element="ns1:doubleItResponse"/>
    </wsdl:message>
    <wsdl:portType name="DoubleItPortType">
        <wsdl:operation name="doubleIt">
            <wsdl:input name="doubleIt" message="ns1:doubleIt"/>
            <wsdl:output name="doubleItResponse"
                message="ns1:doubleItResponse"/>
        </wsdl:operation>
    </wsdl:portType>
</wsdl:definitions>
```

The second file, `DoubleItPortType.wsdl` imports the former file and provides the explicit `wsdl:binding` and `wsdl:service` connection information. The `wsdl:service` incorporates the service name and port name values specified on the Java web service implementation above.

```
<wsdl:definitions name="DoubleItService"
    targetNamespace="http://www.example.org/contract/DoubleIt">
    <wsdl:import namespace="http://service/" location="DoubleItPortType.wsdl"/>
    <wsdl:binding name="DoubleItServiceSoapBinding"
        type="ns1:DoubleItPortType">
        <soap:binding style="document"
            transport="http://schemas.xmlsoap.org/soap/http" />
        <wsdl:operation name="doubleIt">
            <soap:operation soapAction="" style="document" />
            <wsdl:input name="doubleIt">
                <soap:body use="literal" />
            </wsdl:input>
            <wsdl:output name="doubleItResponse">
                <soap:body use="literal" />
            </wsdl:output>
        </wsdl:operation>
    </wsdl:binding>
    <wsdl:service name="DoubleItService">
        <wsdl:port name="DoubleItPort"
            binding="tns:DoubleItServiceSoapBinding">
            <soap:address location="http://localhost:9090/DoubleItPort" />
        </wsdl:port>
    </wsdl:service>
```

```
</wsdl:definitions>
```

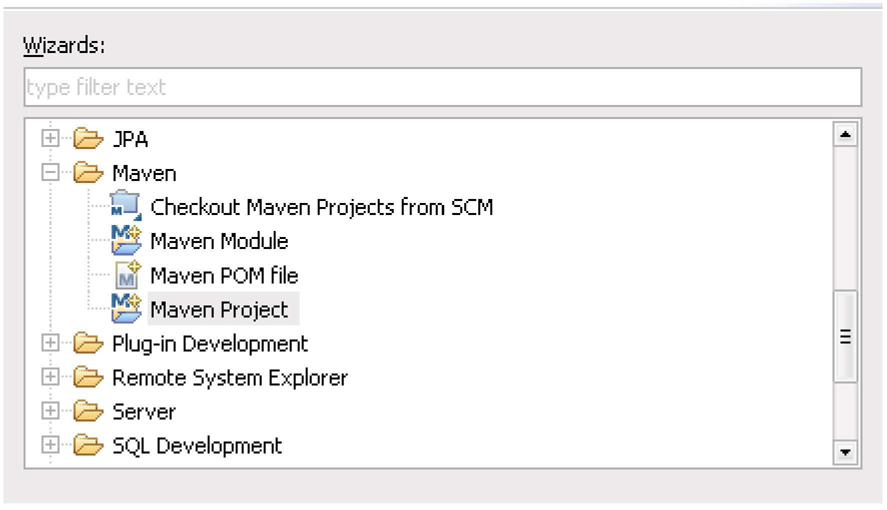
This sample can be compiled and deployed just as explained in the previous wsdl-first example--only difference, for Talend ESB OSGi deployment, to use **`install mvn:org.talend.cxf-examples.dev-guide-java-first/dev-guide-java-first-service/5.2.1`** as the bundle install string.

In the next Java-first example we'll demonstrate other helpful tools for web services development, including the m2eclipse plugin, Apache CXF's Maven archetypes for creating skeleton code and soapUI for making test SOAP calls.

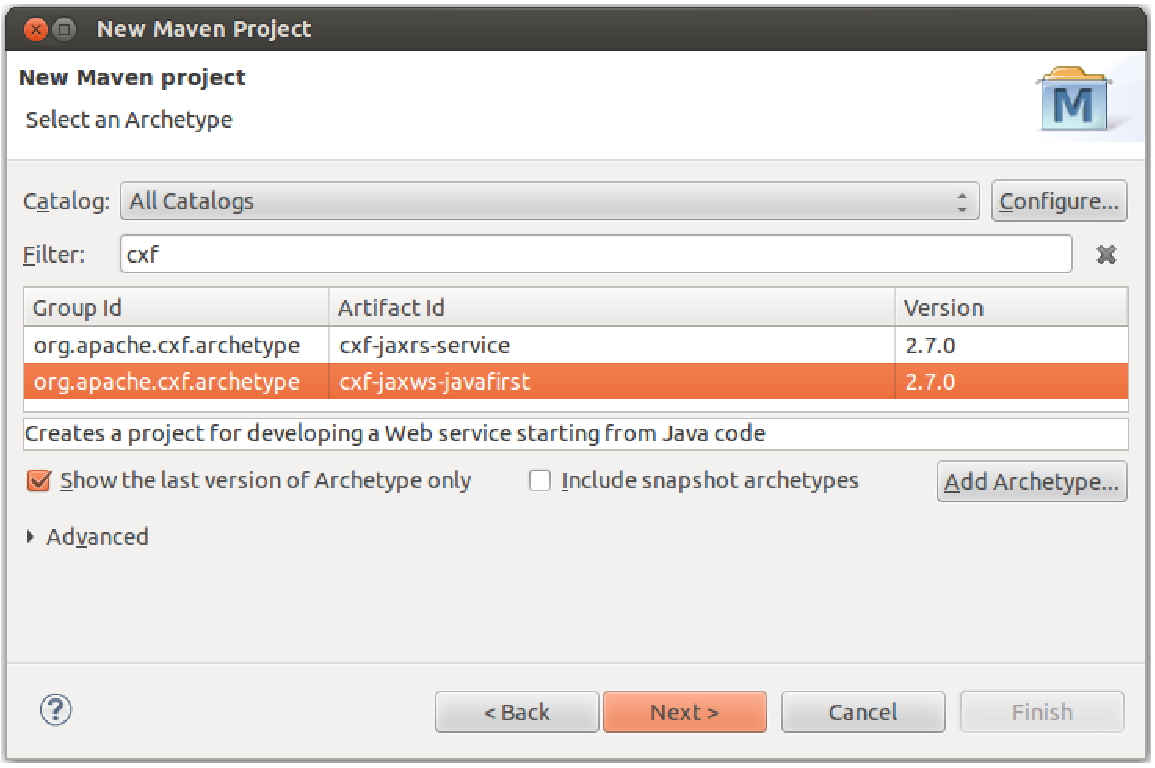
2.2.1. CXF Maven Archetypes

Apache CXF provides a Maven archetype for creating Java-first web services. In the this section we'll explore using it along with the Eclipse's m2eclipse plugin. Open Eclipse:

1. From Main Menu: File>New>Other, Select "Maven Project" under "Maven" category:



2. Click **Next** to get the "Select project name and location" screen, accept its defaults, and click **Next** again to get to the "Select an Archetype" dialog. On this page, enter "cxf" in the Filter box and select the item with group ID of `org.apache.cxf.archetype` and artifact ID of `cxf-jaxws-javafirst`:



Catalog: All Catalogs

Filter: cxf

Group Id	Artifact Id	Version
org.apache.cxf.archetype	cxf-jaxrs-service	2.7.0
org.apache.cxf.archetype	cxf-jaxws-javafirst	2.7.0

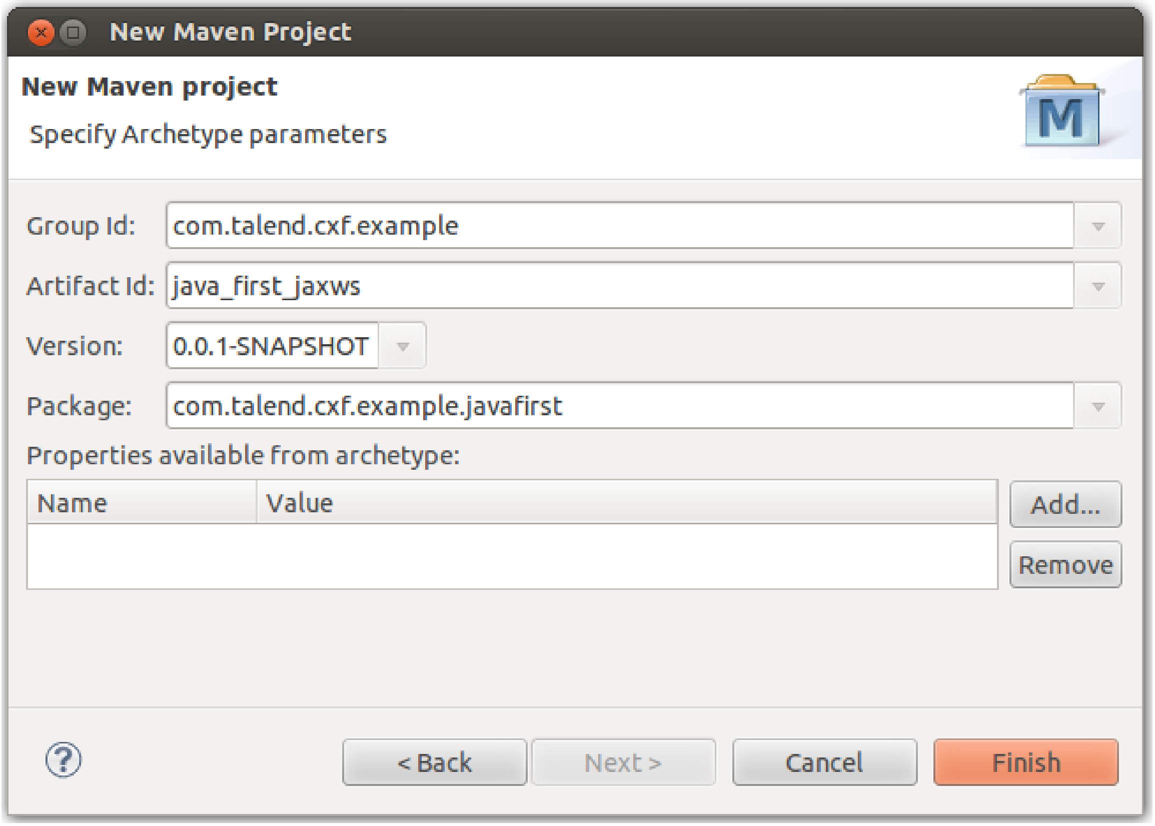
Creates a project for developing a Web service starting from Java code

☑ Show the last version of Archetype only ☐ Include snapshot archetypes

If the CXF archetype is not already available in your Eclipse installation, add it by selecting **Add Archetype...** with the following information:

- Archetype Group Id: `org.apache.cxf.archetype`
- Archetype Artifact Id: `cxf-jaxws-javafirst`
- Archetype Version:
- Repository URL: `http://repo1.maven.org/maven2`

3. Then, Click **Next**. We need to fill the required fields, which we can do as below:


New Maven Project

New Maven project

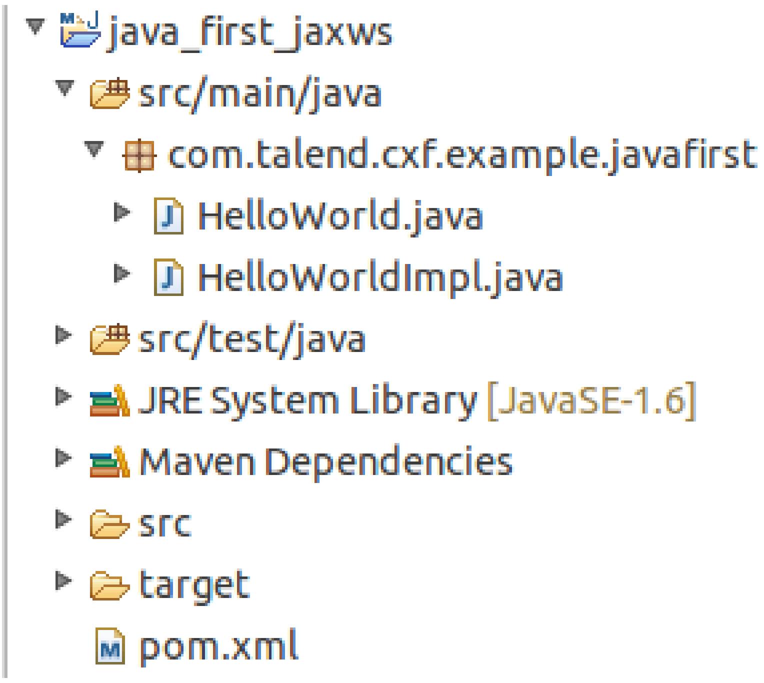
Specify Archetype parameters

Group Id:	com.talend.cxf.example
Artifact Id:	java_first_jaxws
Version:	0.0.1-SNAPSHOT
Package:	com.talend.cxf.example.javafirst

Properties available from archetype:

Name	Value

4. Click **Finish**, the project skeleton will be generated with a structure as below:


```
java_first_jaxws
  src/main/java
    com.talend.cxf.example.javafirst
      HelloWorld.java
      HelloWorldImpl.java
  src/test/java
  JRE System Library [JavaSE-1.6]
  Maven Dependencies
  src
  target
  pom.xml
```

We have the project skeleton that we can start from now, and add Java methods to represent web service operations we wish to implement. "HelloWorld.java" is the simple interface that this archetype generates, along with an ready-to-run implementation (HelloWorldImpl.java) of it. Of course both can be changed when implementing your own web service provider.

Since the CXF Maven archetype does not provide a test SOAP client or provide OSGi deployment capability, in the next sections we'll show how to manually add in OSGi configuration as well as use soapUI to make SOAP calls.

2.2.2. Adding OSGi Capabilities to a Web Service

This chapter shows how to configure a Mavenized web service as an OSGi bundle in Talend ESB, an OSGi container based on Apache Karaf. For more information about Talend ESB, Karaf, and OSGi, please see the *Talend ESB Container Administration Guide*.

Let's package the java_first_jaxws web service created in the previous section as an OSGi bundle. We'll configure an Apache Felix plugin in Maven to for this. For more information about Felix, please visit http://felix.apache.org; for more information on using Felix with Maven, please refer to http://felix.apache.org/site/apache-felix-maven-bundle-plugin-bnd.html.

In order to package the application as a bundle, first we need to add the Felix Maven dependency to the `pom.xml` created in the previous section:

```
<dependency>
    <groupId>org.apache.felix</groupId>
    <artifactId>org.osgi.core</artifactId>
    <version>1.4.0</version>
</dependency>
```

Also, we'll need to add the Felix plugin used for creating the bundle. Create a new `plugins` element under the `project's build` element (not the `build / pluginManagement / plugins` element, that is used for configuration outside of Maven's default build process) and add:

```
<plugin>
    <groupId>org.apache.felix</groupId>
    <artifactId>maven-bundle-plugin</artifactId>
    <extensions>true</extensions>
    <version>2.3.7</version>
    <configuration>
        <instructions>
            <Bundle-SymbolicName>
                ${project.groupId}.${project.artifactId}
            </Bundle-SymbolicName>
            <Bundle-Name>${project.name}</Bundle-Name>
            <Bundle-Version>${project.version}</Bundle-Version>
            <Export-Package>com.talend.cxf.example.javafirst</Export-Package>
            <Bundle-Activator>
                com.talend.cxf.example.javafirst.Activator
            </Bundle-Activator>
            <Require-Bundle>
                org.apache.cxf.bundle,org.springframework.beans
            </Require-Bundle>
        </instructions>
    </configuration>
</plugin>
```

Since we want to package as an OSGi bundle, also change the `packaging` element at the top of the pom file from `war` to `bundle`. As shown above in Felix's maven-bundle-plugin configuration `com.talend.cxf.example.javafirst` is exported as the bundle name and a CXF dependency is listed. In addition, the "Bundle-Activator" implementation is given. For bundle activation, we'll start and stop our service in the Activator's start and stop services respectively. Place the following class within the java_first_jaxws project:

Activator.java:

```
package com.talend.cxf.example.javafirst;

import javax.xml.ws.Endpoint;
import org.osgi.framework.BundleActivator;
import org.osgi.framework.BundleContext;
```

```
public class Activator implements BundleActivator {
  private Endpoint endpoint;

  public void start(BundleContext arg0) throws Exception {
    try {
      HelloWorldImpl implementor = new HelloWorldImpl();
      String address = "http://localhost:9000/helloWorld";
      endpoint = Endpoint.publish(address, implementor);
      System.out.println("Server is started...");
    } catch (Exception e) {
      e.printStackTrace(); throw e;
    }
  }

  public void stop(BundleContext arg0) throws Exception {
    try {
      endpoint.stop();
    } catch (Exception e) {
      e.printStackTrace();
      throw e;
    }
  }
}
```

All changes needed have been made. Now let's have Maven create the package:

Select the "Run As> Maven Clean" and then "Run As> Maven Install" from the popup menu on `pom.xml`, or alternatively, **`mvn clean install`** from a command prompt located in the project home directory. The application will be packaged and installed into your Maven local repository, by default located in your hidden <user home>/.m2 directory or otherwise as configured by the *`localRepository`* field in your `${Maven_HOME}/conf/settings.xml` file. You should find it under `${MavenRepository}/ com/talend/cxf/example/ java_first_jaxws/0.0.1-SNAPSHOT/ java_first_jaxws-0.0.1-SNAPSHOT.jar`.

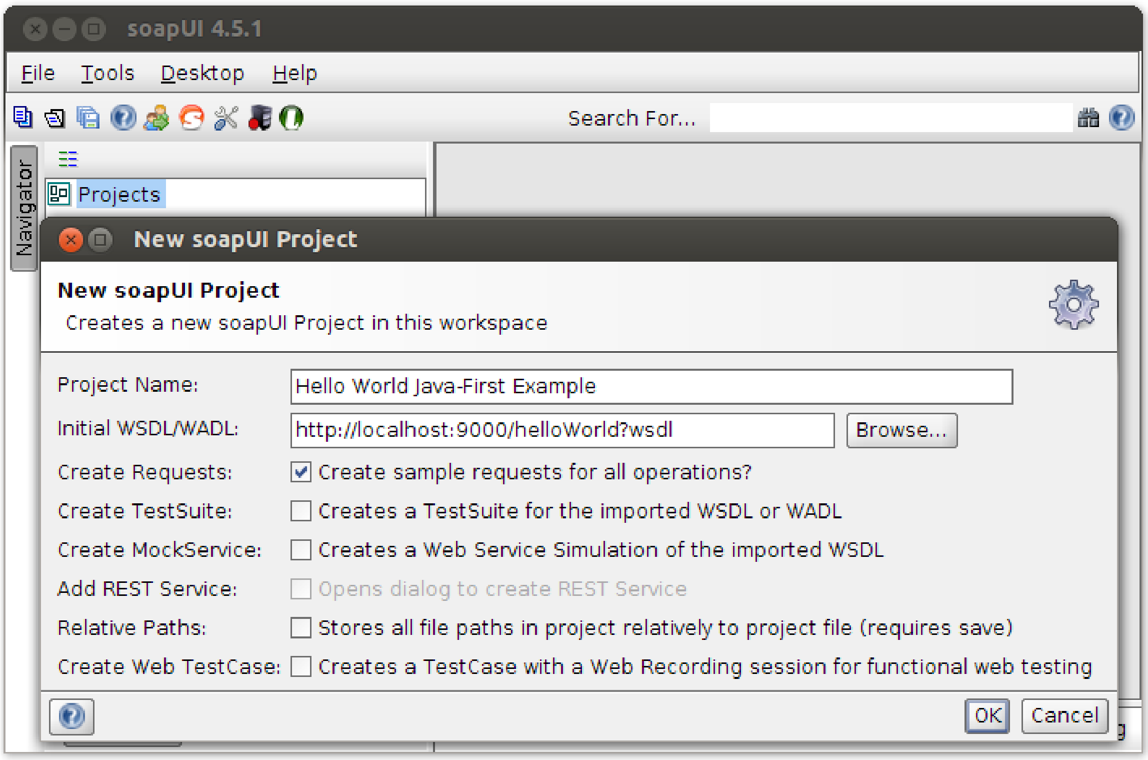
We're now ready to deploy the bundle, which can be done as described in Section 2.1.6.1, *"Talend ESB (OSGi)"* except with an install command of: **`install mvn:com.talend.cxf.example/ java_first_jaxws/0.0.1-SNAPSHOT`**. Run the **`list`** command to make sure the bundle has started (check the logfiles in `container/log folder` for any errors if not) and ensure you can see the service WSDL at `http://localhost:9000/helloWorld?wsdl`. If so, we're ready to make SOAP calls to the service using soapUI as shown in the next section.

2.2.3. Making SOAP calls with soapUI

In this section we'll use soapUI to make SOAP calls to the Talend ESB-hosted web service created in the previous section. SoapUI's detailed tutorial is recommended for a full understanding of this tool's capabilities.

1. (Optional) From your browser, you may wish to save the service WSDL to a file, such as `helloWorld.wsdl`, for subsequent usage by soapUI. However, soapUI can also easily read WSDLs from HTTP URLs such as http://localhost:9000/helloWorld?wsdl.

2. Start soapUI and select menu item File->New soapUI Project. Enter a name for the project and the web service's URL either from a file or http location, the latter as shown below. Then click **OK**.

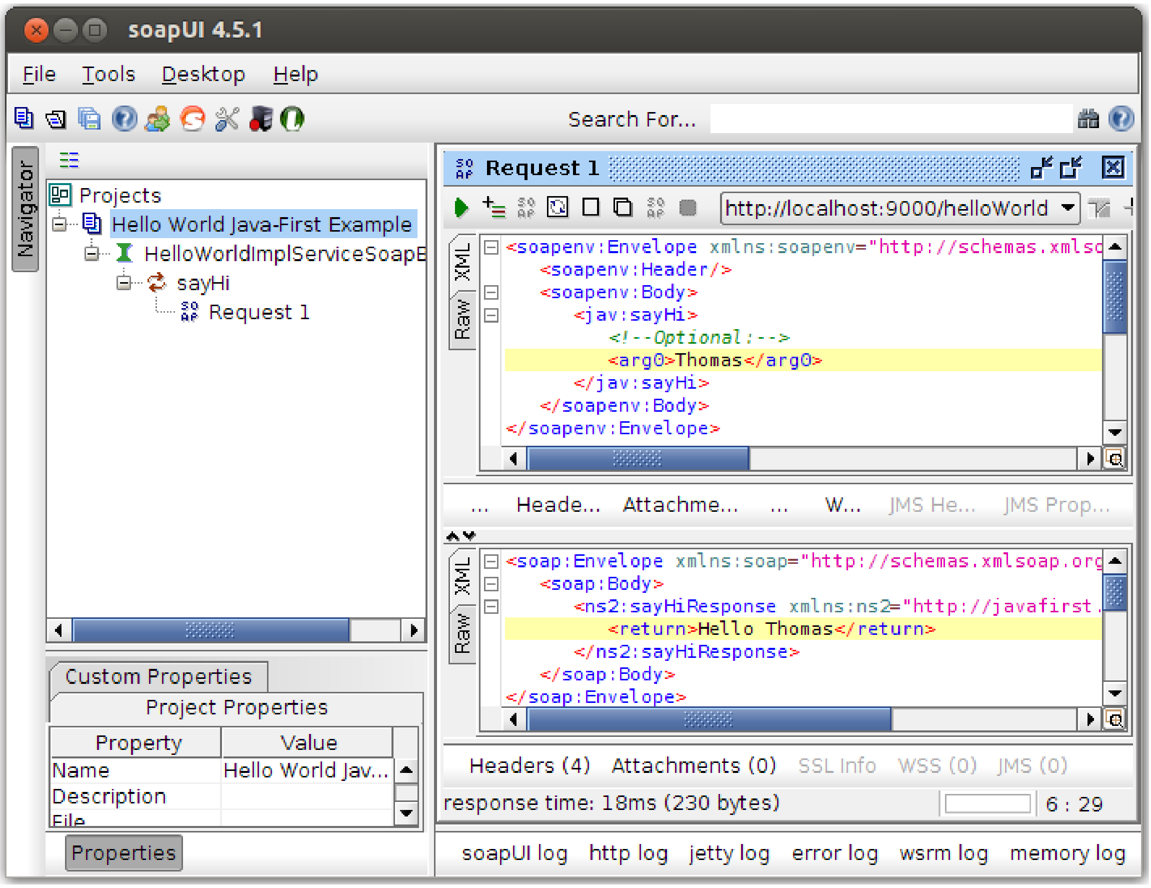


New soapUI Project

Creates a new soapUI Project in this workspace

Project Name:	Hello World Java-First Example
Initial WSDL/WADL:	http://localhost:9000/helloWorld?wsdl
Create Requests:	[✓] Create sample requests for all operations?
Create TestSuite:	Creates a TestSuite for the imported WSDL or WADL
Create MockService:	Creates a Web Service Simulation of the imported WSDL
Add REST Service:	Opens dialog to create REST Service
Relative Paths:	Stores all file paths in project relatively to project file (requires save)
Create Web TestCase:	Creates a TestCase with a Web Recording session for functional web testing

3. Fully expand the project node in the left-side navigator. Under the "HelloWorldImplSoapBinding", you'll see the web service's "sayHi" operation and a "Request 1" tree item for entering your web service request. Double-click the "Request 1"" item, and in the SOAP request message the pops up in the right-side window, enter a name within the <arg0></arg0> element. Then select the green arrow in the SOAP request message window to make the SOAP call. You'll see the SOAP response from the server appear, as shown below:


soapUI 4.5.1
File Tools Desktop Help
Search For...
Navigator
Projects
Hello World Java-First Example
HelloWorldImplServiceSoapB
sayHi
Request 1
Custom Properties
Project Properties
Properties
Request 1
XML
Raw
... Heade... Attachme... ... W... JMS He... JMS Prop...
Headers (4) Attachments (0) SSL Info WSS (0) JMS (0)
soapUI log http log jetty log error log wsrm log memory log

http://localhost:9000/helloWorld

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsc
   <soapenv:Header/>
   <soapenv:Body>
      <jav:sayHi>
         <!--Optional:-->
         <arg0>Thomas</arg0>
      </jav:sayHi>
   </soapenv:Body>
</soapenv:Envelope>
```

```
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org
   <soap:Body>
      <ns2:sayHiResponse xmlns:ns2="http://javafirst.
         <return>Hello Thomas</return>
      </ns2:sayHiResponse>
   </soap:Body>
</soap:Envelope>
```

Property	Value
Name	Hello World Jav...
Description	
File	

response time: 18ms (230 bytes) 6 : 29

You can make additional calls by editing the request window and pressing the green arrow.

2.3. REST Services

The JAX-RS Section on the Apache CXF website provides a solid background to implementing REST services and also provides the latest information on the newest RESTful features offered by CXF.

For an example of working with a RESTful application in Eclipse and deploying the service to either Tomcat or the Talend OSGi container, let's look at the JAXRS-Intro sample provided in the `examples/talend` folder of the Talend ESB installation. The demo lists the Persons who are part of a generic membership, and allows GETs to retrieve a single member or all members, POSTs to add members, and PUTs for updates to membership information.

The JAX-RS Server provides one service via the registration of a root resource class, MembershipService which relies on within-memory data storage. MembershipService provides a list of its members, which are individual Person objects containing name and age. New persons can be added to the MembershipService, and individual members can have their information updated. The RESTful client uses CXF JAX-RS WebClient to traverse all the information about an individual Person and also add a new child.

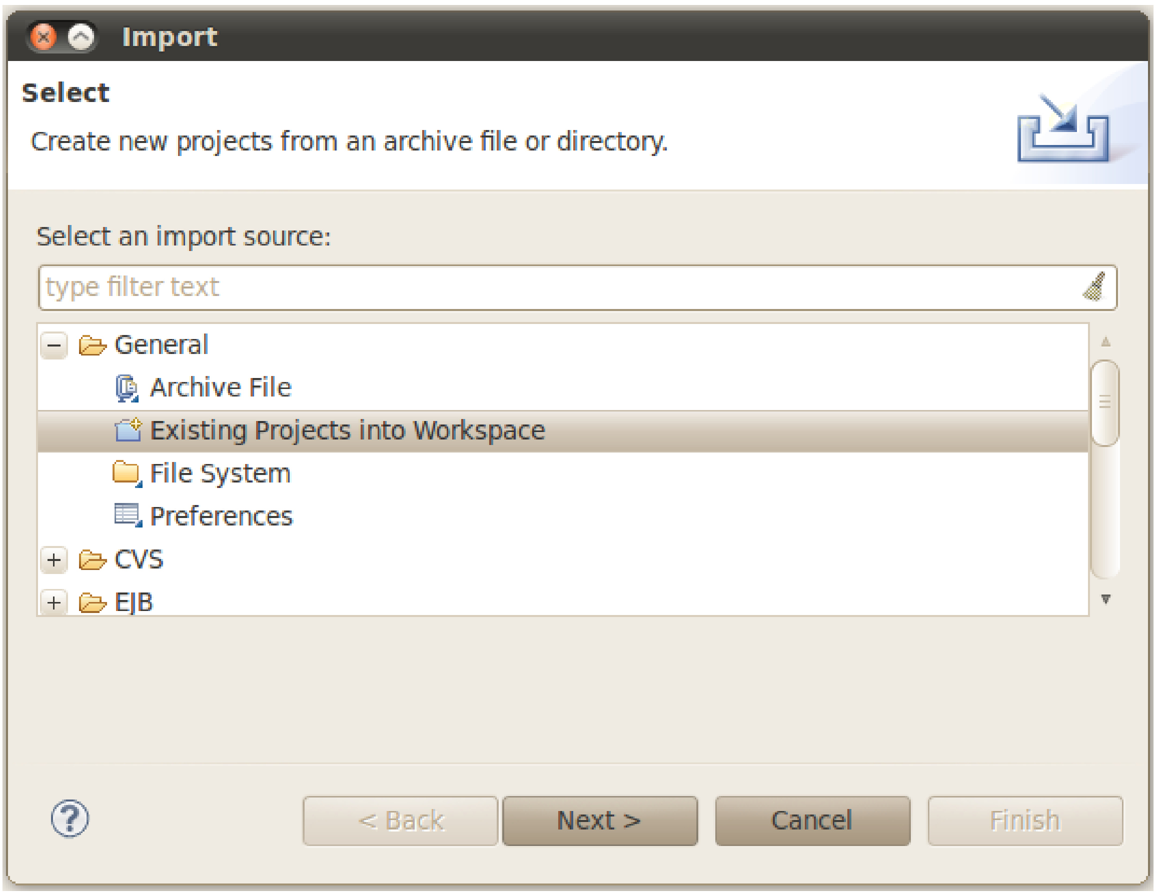
This sample consists of four subfolders:

Folder	Description
client	This is a sample client application that uses the CXF JAX-RS API to create HTTP-centric and proxy clients and makes several calls with them.
common	This directory contains the code that is common for both the client and the server. POJOs and the REST interface is kept here.
service	This is the JAX-RS service holding the Membership root resources packaged as an OSGi bundle.
war	This module creates a WAR archive containing the code from common and service modules.

Working with a REST sample in Eclipse

1. From a command-line windows, navigate to the jax-rs folder and type **`mvn clean install eclipse:eclipse`**. This will create an Eclipse project out of this sample that we can import into Eclipse.

2. From Eclipse we can now import the project. From the Menu row, select **`File : Import...`**, and from the resulting Import popup, choose Existing Projects into Workspace (see illustration below). Select Next.



3. Select the four Eclipse projects comprising this example: `jaxrs-intro-client`, `jaxrs-intro-common`, `jaxrs-intro-service-bundle`, and `jaxrs-intro-service-war`. You'll see them listed in the left-side Eclipse Navigator and Project Explorer views. At this stage any of the files can be viewed and modified. Be sure to run `mvn clean install` from the `jaxrs-intro` folder within a command prompt window after any changes made.

4. Prior to running the client, we'll need to activate the REST service, which we can do in at least two ways:

   - To run the example within Talend ESB, we'll need to create the Karaf features file that contains the definition for this service. First, from a command prompt navigate to the `features` folder (sibling to `jaxrs-intro`) and run **`mvn clean install`**. Next, from the command prompt enter **`features:addurl mvn:com.talend.sf.examples/osgi/1.0/xml/features`** to install the features file followed by **`features:install tsf-example-jaxrs-intro`** to install the JAXRS-Intro service.

   - To run the example within CXF's internal (Jetty-based) servlet container, navigate to the `war` folder and run **`mvn jetty:run`**.

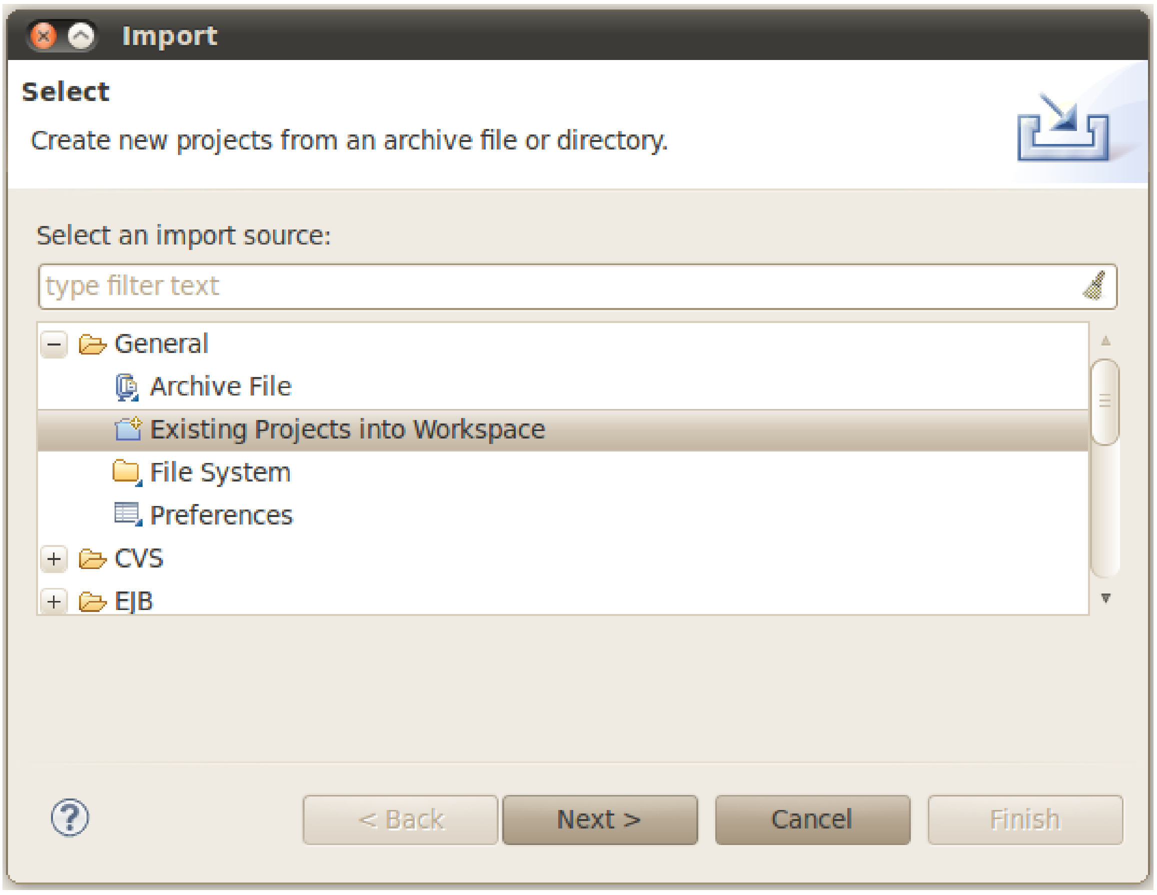
5. To run the client, from a command prompt in the jaxrs-intro/client folder, run `mvn exec:java`.

Chapter 3. Camel Routes Overview

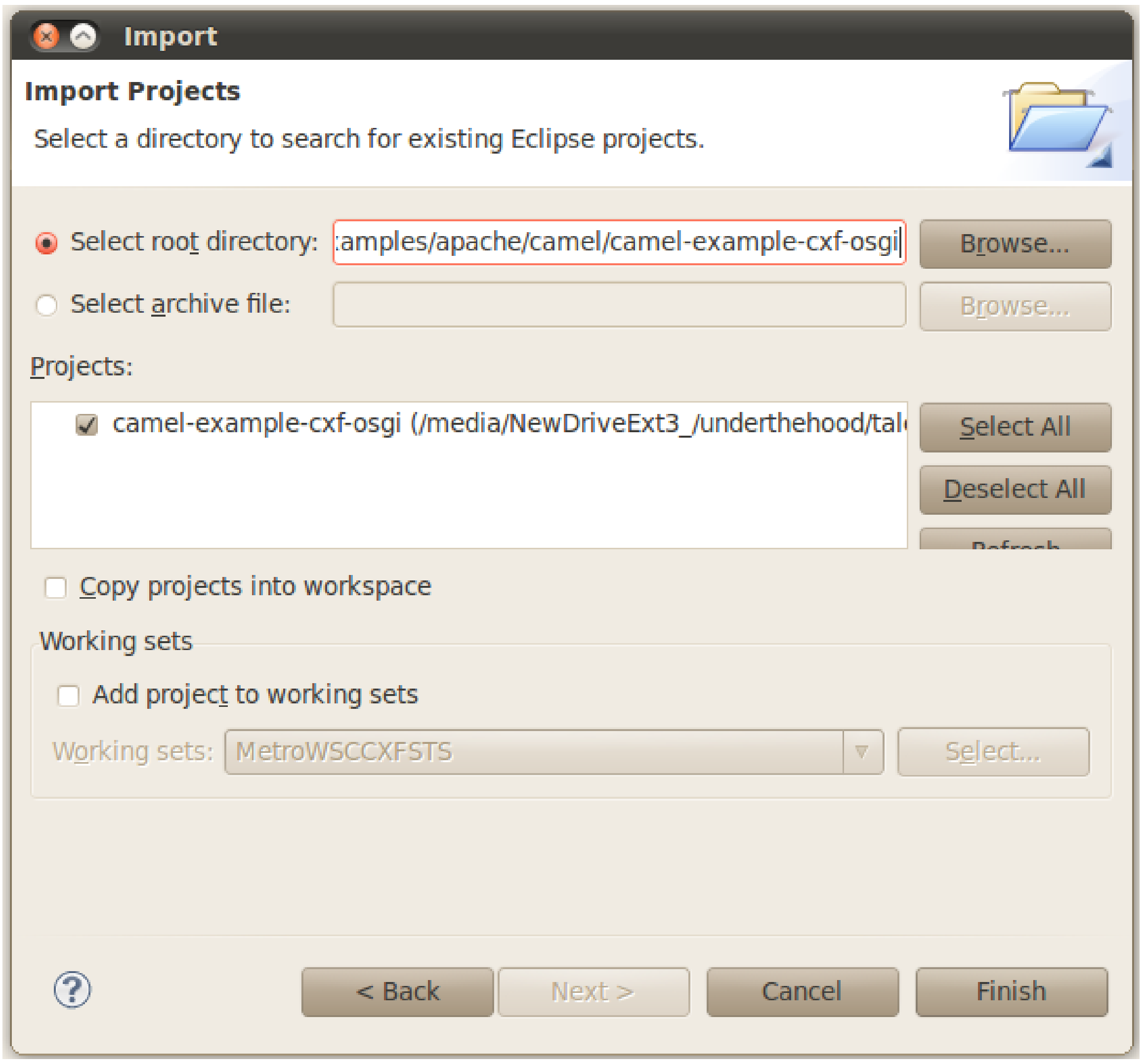
To demonstrate the usage and deployment of a Camel route within Talend ESB using Eclipse, we'll use Camel's `camel-example-cxf-osgi` example, located within the `examples/apache/camel` folder of the Talend ESB distribution. Steps:

1. From a command-line windows, navigate to this folder and type **`mvn clean install eclipse:eclipse`**. This will create an Eclipse project out of this sample that we can import into Eclipse.

2. From Eclipse we can now import the project. From the Menu row, select **`File : Import...`**, and from the resulting Import popup, choose Existing Projects into Workspace (see illustration below). Select Next.



3. For the root directory navigate to the `examples/apache/camel/camel-example-cxf-osgi` folder and select the `camel-example-cxf-osgi` example from the Projects list. Select "Finish" and you'll see it in the Eclipse Package Explorer. Here would be a good time to open up the project source files and look at the code (this example is explained on the Apache Camel site at http://camel.apache.org/cxf-example-osgi.html.)

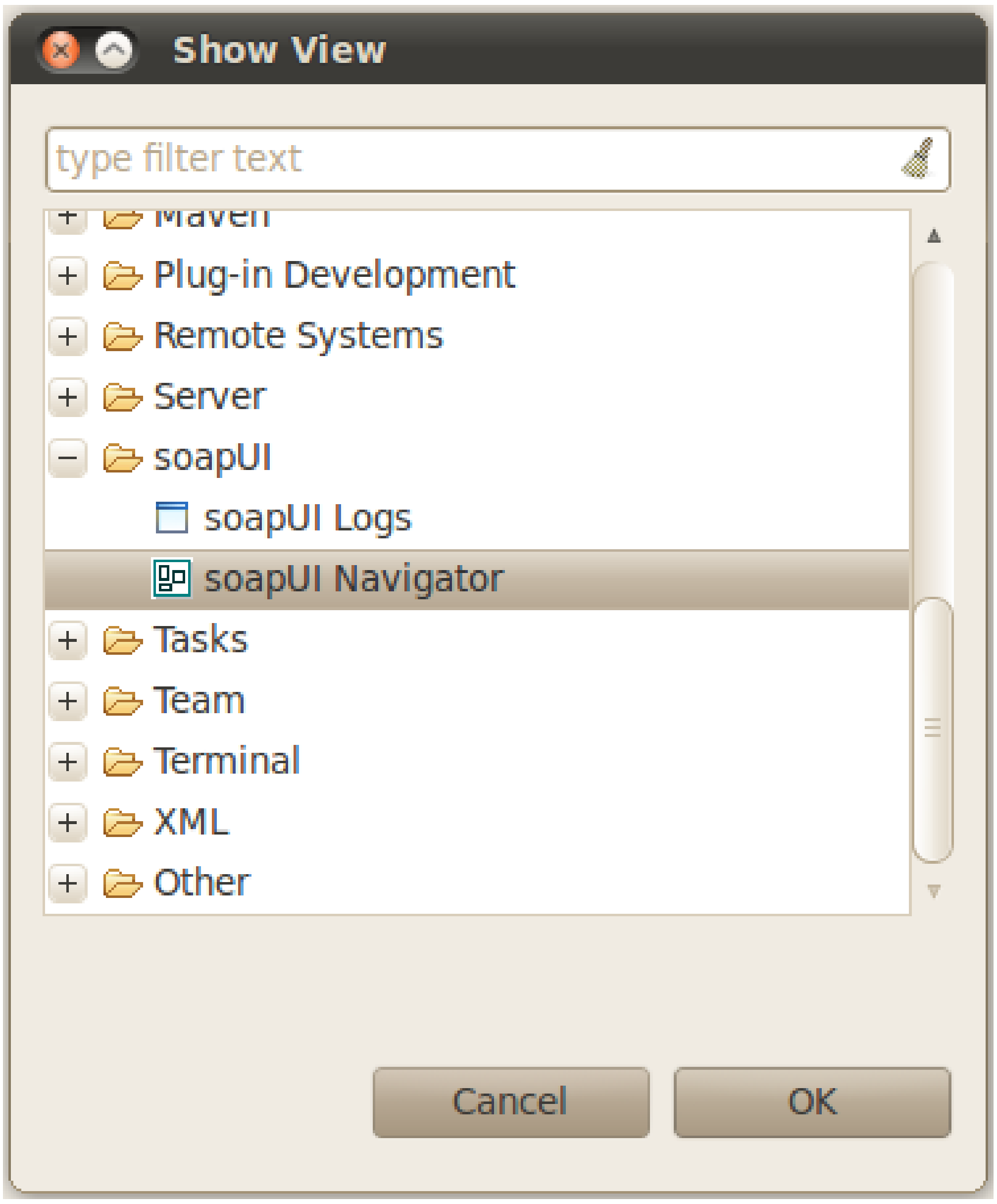

Import
Import Projects
Select a directory to search for existing Eclipse projects.
Select root directory: :amples/apache/camel/camel-example-cxf-osgi
Browse...
Select archive file:
Browse...
Projects:
camel-example-cxf-osgi (/media/NewDriveExt3_/underthehood/tal
Select All
Deselect All
Copy projects into workspace
Working sets
Add project to working sets
Working sets: MetroWSCCXFSTS
Select...
< Back
Next >
Cancel
Finish

4. As this example runs in the Talend OSGi container, we'll need to start the container prior to running this example. Navigate to the `<TalendRuntimePath>/container/bin` folder and enter **`trun.bat`** or **`./trun`**. Enter the following commands at the resulting console to install the example:

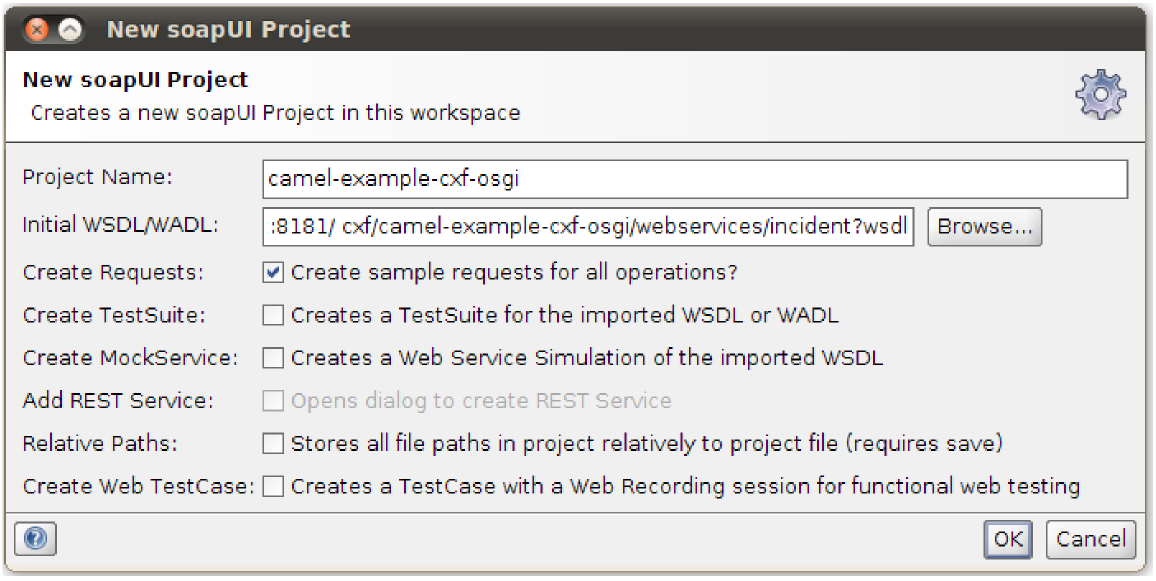
```
features:addUrl mvn:org.apache.camel.karaf/apache-camel/2.10.2/xml/feat
ures
features:install war
features:install camel-spring
features:install camel-jaxb
features:install camel-cxf
osgi:install -s mvn:org.apache.camel/camel-example-cxf-osgi/2.10.2
```

5. Open a web browser and make sure you can view the above web service WSDL at http://localhost:8040/services/camel-example-cxf-osgi/webservices/incident?wsdl before continuing.

6. We'll make a SOAP call using soapUI in this step. Make sure you've already installed soapUI in Eclipse as discussed in Chapter 1, *Development Environment Setup* (standalone soapUI is also fine.) From Eclipse, select Menu Item Window | Show View | Other..., and select soapUI Navigator from the View list (see illustration below.)



7. Create a new project called camel-example-cxf-osgi. Point to the following url: http://localhost:8181/cxf/camel-example-cxf-osgi/webservices/incident?wsdl


New soapUI Project

New soapUI Project
Creates a new soapUI Project in this workspace

Project Name:	camel-example-cxf-osgi
Initial WSDL/WADL:	:8181/ cxf/camel-example-cxf-osgi/webservices/incident?wsdl
Create Requests:	[✓] Create sample requests for all operations?
Create TestSuite:	☐ Creates a TestSuite for the imported WSDL or WADL
Create MockService:	☐ Creates a Web Service Simulation of the imported WSDL
Add REST Service:	☐ Opens dialog to create REST Service
Relative Paths:	☐ Stores all file paths in project relatively to project file (requires save)
Create Web TestCase:	☐ Creates a TestCase with a Web Recording session for functional web testing

8. In the soapUI Navigator view, open the request 1 (under camel-example-cxf-osgi --> ReportIncidentBinding --> ReportIncident) and copy and paste the following SOAP Message:

```
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Header />
    <soap:Body>
        <ns2:inputReportIncident
            xmlns:ns2="http://reportincident.example.camel.apache.org">
            <incidentId>111</incidentId>
            <incidentDate>2011-10-05</incidentDate>
            <givenName>Bob</givenName>
            <familyName>Smith</familyName>
            <summary>incident summary</summary>
            <details>incident summary details</details>
            <email>bobsmith@email.com</email>
            <phone>123-456-7890</phone>
        </ns2:inputReportIncident>
    </soap:Body>
</soap:Envelope>
```

9. Press the green arrow in the soapUI navigator to make the SOAP call. Within the Navigator View you'll see the SOAP response stating that the incident report was accepted. Also, checking a new `target/inbox` folder under the `camel-example-cxf-osgi` sample directory you'll see a file was created storing the SOAP request, completing the Camel route.

Chapter 4. Talend ESB Services Overview

This section looks at accessing the Talend ESB services: Service Locator and Service Activity Monitoring (SAM) from an Eclipse development environment.

For more details on these services, please see *Talend ESB Getting Started Guide* and *Talend ESB Infrastructure Services Configuration Guide*.

4.1. Service Locator

The Service Locator provides service consumers with a mechanism to register, and also discover service endpoints at runtime, thus isolating consumers from the knowledge about the physical location of the endpoint. Talend ESB uses Apache ZooKeeper as its service locator server, located within the Talend ESB distribution at "<TalendRuntimePath>/zookeeper". Please see http://zookeeper.apache.org/" for more information about ZooKeeper. Also note the examples folder of the Talend ESB distribution provides a "locator" example you can learn from.

We'll look at a simple greeting example to show you how to use the Service Locator.

4.1.1. Service interface

Within Eclipse:

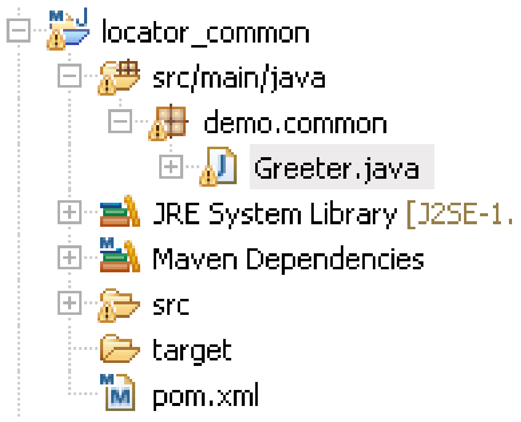
1. Create a Maven project, following the same steps as Section 2.2.1, "*CXF Maven Archetypes*", and call it "locator_common" for the purposes of this example.

2. Remove all default sources, as well as test source folder.

3. Create a package named "demo.common", and create a interface `Greeter.java`.

```
package demo.common;

import javax.jws.WebService;

@WebService(targetNamespace = "http://talend.org/esb/examples/",
        name = "Greeter")
public interface Greeter {
    String greetMe(String requestType);
}
```

Greeter.java will be the service interface. Now, the project structure will look like the following:



4. The common application will be deployed as an OSGi bundle. So we'll need to edit the `pom.xml`. (Please refer to Section 2.2.3, *“Making SOAP calls with soapUI”* for details.)

```
<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.talend.liugang.cxf</groupId>
    <artifactId>locator_common</artifactId>
    <version>1.0.0</version>
    <packaging>bundle</packaging>
    <name>locator_common</name>
    <url>http://maven.apache.org</url>

    <dependencies>
        <dependency>
            <groupId>org.apache.felix</groupId>
            <artifactId>org.osgi.core</artifactId>
            <version>1.4.0</version>
        </dependency>
    </dependencies>
    <build>
        <plugins>
            <plugin>
                <groupId>org.apache.felix</groupId>
                <artifactId>maven-bundle-plugin</artifactId>
                <extensions>true</extensions>
                <version>2.3.7</version>
                <configuration>
                    <instructions>
                        <Bundle-SymbolicName>
                            ${project.artifactId}
                        </Bundle-SymbolicName>
                        <Export-Package>
```

```
                                demo.common
                            </Export-Package>
                        </instructions>
                    </configuration>
                </plugin>
            </plugins>
        </build>
    </project>
```

Now we've finished the definition of the service. Select "Run As->Maven Install" from the M2Eclipse Popup menu on the pom.xml to install the application into your Maven repository.

Next we'll look at the implementation of this service.

4.1.2. Service implementation

This time, we'll create a "locator_service" project first, following the steps as above. Then create a `GreeterImpl.java` which implements the Greeter interface defined above. The contents of GreeterImpl.java are:

```
import javax.jws.WebService;

import demo.common.Greeter;
@WebService(targetNamespace = "http://talend.org/esb/examples/",
        serviceName = "GreeterService")
public class GreeterImpl implements Greeter {

    public String greetMe(String me) {
        System.out.println("Executing operation greetMe");
        System.out.println("Message received: " + me + "\n");
        return "Hello " + me;
    }
}
```

For each input, a statement "'Hello '+input" will be returned. Now it's time to bring the ServiceLocator in. As we said at the beginning of this section, the Service Locator is a mechanism to discover service endpoints at runtime. In order to make the Implementation discoverable, we need to register it first.

There are two ways to register a service: by Spring configuration or by code directly.

For Spring 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"
    xmlns:jaxws="http://cxf.apache.org/jaxws"
    xsi:schemaLocation="
        http://www.springframework.org/schema/beans
        http://www.springframework.org/schema/beans/spring-beans.xsd
        http://cxf.apache.org/jaxws http://cxf.apache.org/schemas/jaxws.xsd">
    <import resource="classpath:META-INF/cxf/cxf.xml" />
    <import resource="classpath:META-INF/tesb/locator/beans-osgi.xml" />

    <jaxws:endpoint xmlns:tns="http://talend.org/esb/examples/"
        id="greeter" implementor="demo.service.GreeterImpl"
        serviceName="tns:GreeterService"
        address="/GreeterService">
        <jaxws:features>
```

```
            <bean class="org.talend.esb.servicelocator.cxf.LocatorFeature">
            </bean>
        </jaxws:features>
    </jaxws:endpoint>
</beans>
```

Note for the above Spring file the OSGi import line (`classpath:META-INF/tesb/locator/beans-osgi.xml`) is the only difference from a standard Spring configuration file.

Then load it by using "ClassPathXmlApplicationContext". It's important to include the configuration file in exported bundle and also add the necessary dependencies for Spring configuration.

Note the <jaxws:features></jaxws:features> lines, which add a feature "org.talend.esb.servicelocator.cxf.LocatorFeature", for using the Service Locator.

The alternative code version is:

```
LocatorFeature locatorFeature = new LocatorFeature();
Greeter greeterService = new GreeterImpl();
svrFactory = new JaxWsServerFactoryBean();
// WSDL operations that service will implement
svrFactory.setServiceClass(Greeter.class);
// endpoint service will listen on
svrFactory.setAddress("http://localhost:8082/services/Greeter");
// implementation of WSDL operations
svrFactory.setServiceBean(greeterService);
// attach LocatorFeature to web service provider
svrFactory.getFeatures().add(locatorFeature);
svrFactory.create();
```

Similar to Section 4.1, *“Service Locator”*, we'll export "locator_service" as a bundle, so the BundleActivator is the best place to register or remove this service:

```
import org.apache.cxf.jaxws.JaxWsServerFactoryBean;
import org.osgi.framework.BundleActivator;
import org.osgi.framework.BundleContext;
import org.talend.esb.servicelocator.cxf.LocatorFeature;

import demo.common.Greeter;

public class Activator implements BundleActivator {

    private JaxWsServerFactoryBean svrFactory;

    public void start(BundleContext context) throws Exception {
        LocatorFeature locatorFeature = new LocatorFeature();
        Greeter greeterService = new GreeterImpl();
        svrFactory = new JaxWsServerFactoryBean();
        svrFactory.setServiceClass(Greeter.class);
        svrFactory.setAddress("http://localhost:8082/services/Greeter");
        svrFactory.setServiceBean(greeterService);
        svrFactory.getFeatures().add(locatorFeature);
        svrFactory.create();
    }

    public void stop(BundleContext context) throws Exception {
        svrFactory.destroy();
    }
}
```

There's all the code we need to provide. Next, we need to configure the pom.xml, add necessary dependencies, and configure the exported bundle information.

Finally, the contents of pom.xml are:

```
<groupId>com.talend.liugang.cxf</groupId>
<artifactId>locator_service</artifactId>
<version>1.0.0</version>
<packaging>bundle</packaging>

<name>locator_service</name>
<url>http://maven.apache.org</url>
<properties>
    <cxf.version>2.6.0</cxf.version>
</properties>

<dependencies>
    <dependency>
        <groupId>org.apache.cxf</groupId>
        <artifactId>cxf-api</artifactId>
        <version>${cxf.version}</version>
    </dependency>

    <dependency>
        <groupId>org.apache.cxf</groupId>
        <artifactId>cxf-rt-frontend-jaxws</artifactId>
        <version>${cxf.version}</version>
        <scope>compile</scope>
    </dependency>

    <dependency>
        <groupId>org.apache.cxf</groupId>
        <artifactId>cxf-rt-transports-http-jetty</artifactId>
        <version>${cxf.version}</version>
    </dependency>

    <dependency>
        <groupId>org.talend.esb</groupId>
        <artifactId>locator</artifactId>
        <version>5.2.1</version>
    </dependency>

    <dependency>
        <groupId>${project.groupId}</groupId>
        <artifactId>locator_common</artifactId>
        <version>${project.version}</version>
    </dependency>

    <dependency>
        <groupId>org.apache.felix</groupId>
        <artifactId>org.osgi.core</artifactId>
        <version>1.4.0</version>
    </dependency>
</dependencies>
```

```
<build>
    <plugins>
        <plugin>
            <groupId>org.apache.felix</groupId>
            <artifactId>maven-bundle-plugin</artifactId>
            <extensions>true</extensions>
            <version>2.3.7</version>
            <configuration>
                <instructions>
                    <Bundle-SymbolicName>
                        ${project.artifactId}
                    </Bundle-SymbolicName>
                    <Import-Package>demo.common,javax.jws,
                        org.apache.cxf.endpoint,org.apache.cxf.jaxws,
                        org.osgi.framework,org.talend.esb.locator
                    </Import-Package>
                    <Bundle-Activator>demo.service.Activator</Bundle-Activator>
                    <Require-Bundle>
                        org.apache.cxf.bundle;version="2.6.0"
                    </Require-Bundle>
                </instructions>
            </configuration>
        </plugin>
    </plugins>
</build>
```

And also, we installed it into Maven by running "Maven Install".

So far, we have defined the Service interface, and given it an implementation. It's time to write a client which will consume the service.

4.1.3. Service Consumer

This time we will try to consume the service above by using Service Locator instead of referencing the implementor directly.

Same as with service registration, you can use Spring configuration or code directly.

For Spring configuration:

```
<beans xmlns="http://www.springframework.org/schema/beans"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xmlns:jaxws="http://cxf.apache.org/jaxws"
    xmlns:util="http://www.springframework.org/schema/util"
    xmlns:context="http://www.springframework.org/schema/context"
    xsi:schemaLocation="http://www.springframework.org/schema/beans
    http://www.springframework.org/schema/beans/spring-beans-3.0.xsd
    http://cxf.apache.org/jaxws http://cxf.apache.org/schemas/jaxws.xsd
    http://www.springframework.org/schema/context
    http://www.springframework.org/schema/context/spring-context-3.0.xsd
    http://www.springframework.org/schema/util
    http://www.springframework.org/schema/util/spring-util-3.0.xsd ">

    <import resource="classpath:META-INF/cxf/cxf.xml" />
    <import resource="classpath:/META-INF/tesb/locator/beans-osgi.xml" />

    <jaxws:client id="greeterService" address="locator://more_useful_information"
        serviceClass="demo.common.Greeter">
        <jaxws:features>
            <bean class="org.talend.esb.servicelocator.cxf.LocatorFeature">
            </bean>
        </jaxws:features>
    </jaxws:client>
</beans>
```

The alternative code version is:

```
JaxWsProxyFactoryBean factory = new JaxWsProxyFactoryBean();
LocatorFeature locatorFeature = new LocatorFeature();
factory.getFeatures().add(locatorFeature);
factory.setServiceClass(Greeter.class);
factory.setAddress("locator://more_useful_information");
Greeter client = (Greeter) factory.create();
String response = client.greetMe("MyName");
```

An important point to note: We must use the locator protocol for client 'address="locator://more_useful_information"'. And also, we will export the project as a OSGi bundle, so we'll need to setup the test fragment in start() method of BundleActivator:

```
import org.apache.cxf.jaxws.JaxWsProxyFactoryBean;
import org.osgi.framework.BundleActivator;
import org.osgi.framework.BundleContext;
import org.talend.esb.servicelocator.cxf.LocatorFeature;

import demo.common.Greeter;

public class Client implements BundleActivator {

    public void start(BundleContext context) throws Exception {
        JaxWsProxyFactoryBean factory = new JaxWsProxyFactoryBean();
        LocatorFeature locatorFeature = new LocatorFeature();
        factory.getFeatures().add(locatorFeature);
        factory.setServiceClass(Greeter.class);
        factory.setAddress("locator://more_useful_information");
        Greeter client = (Greeter) factory.create();
        String response = client.greetMe("MyName");
        System.out.println(response);
    }

    public void stop(BundleContext context) throws Exception {
    }
}
```

The contents of pom.xml are:

```
<groupId>com.talend.liugang.cxf</groupId>
<artifactId>locator_client</artifactId>
<version>1.0.0</version>
<packaging>bundle</packaging>

<name>locator_client</name>
<url>http://maven.apache.org</url>

<properties>
    <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
    <cxf.version>2.6.0</cxf.version>
</properties>

<dependencies>
    <dependency>
        <groupId>org.apache.cxf</groupId>
        <artifactId>cxf-api</artifactId>
        <version>${cxf.version}</version>
    </dependency>
    <dependency>
        <groupId>org.apache.cxf</groupId>
        <artifactId>cxf-rt-frontend-jaxws</artifactId>
        <version>${cxf.version}</version>
        <scope>compile</scope>
    </dependency>
    <dependency>
        <groupId>org.apache.cxf</groupId>
        <artifactId>cxf-rt-transports-http-jetty</artifactId>
        <version>${cxf.version}</version>
    </dependency>
    <dependency>
        <groupId>org.talend.esb</groupId>
        <artifactId>locator</artifactId>
        <version>5.2.1</version>
    </dependency>
    <dependency>
        <groupId>${project.groupId}</groupId>
        <artifactId>locator_common</artifactId>
        <version>${project.version}</version>
    </dependency>
</dependencies>

<build>
    <plugins>
        <plugin>
            <groupId>org.apache.felix</groupId>
            <artifactId>maven-bundle-plugin</artifactId>
            <extensions>true</extensions>
            <version>2.3.7</version>
            <configuration>
                <instructions>
                    <Bundle-SymbolicName>
                        ${project.artifactId}
                    </Bundle-SymbolicName>
                    <Bundle-Activator>demo.client.Client</Bundle-Activator>
                    <Require-Bundle>locator_common</Require-Bundle>
                </instructions>
            </configuration>
        </plugin>
    </plugins>
</build>
```

Then execute "Run As -> Maven Install" to install this bundle. Thus far we have finished all bundles, now we will see how to install them and also combine them with ServiceLocator.

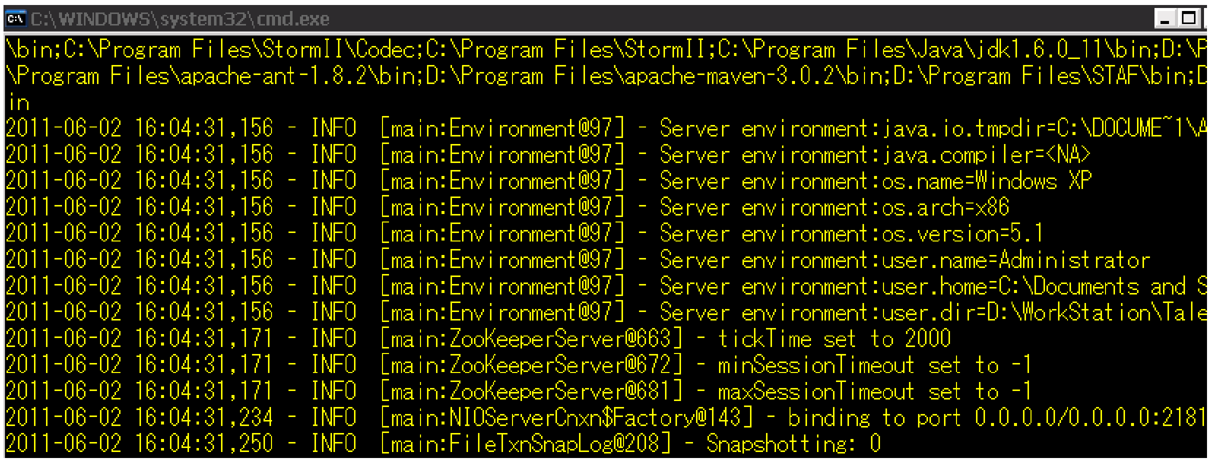
4.1.4. Setup ZooKeeper

Go into `<TalendRuntimePath>/zookeeper`. To start the Service Locator we need to provide a configuration file. The default configuration file is `<TalendRuntimePath>/zookeeper/conf/zoo.cfg`, There's a `zoo_sample.cfg` there, you can just rename the `zoo_sample.cfg` to `zoo.cfg`. For a standalone configuration, you can just give the configuration like below:

```
tickTime=2000
dataDir=./var/locator
clientPort=2181
```

The tickTime refers to the basic unit of time measurement used by ZooKeeper, used for later configuration of timeouts and other parameters. The dataDir holds database snapshots and transaction logs. (Check the ZooKeeper Administration Manual for information on all possible parameters.) Notice that, the `clientPort` number should be same as the `endpointPrefix` defined in LocatorFeature above. Once we have the `zoo.cfg`, we can start or stop the zooKeeper by running

`<TalendRuntimePath>/zookeeper/bin/zkServer.cmd start/stop` on Windows or **`<TalendRuntimePath>/zookeeper/bin/zkServer.sh start/stop`** on Linux:



```
\bin;C:\Program Files\StormII\Codec;C:\Program Files\StormII;C:\Program Files\Java\jdk1.6.0_11\bin;D:\P
\Program Files\apache-ant-1.8.2\bin;D:\Program Files\apache-maven-3.0.2\bin;D:\Program Files\STAF\bin;D
in
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:java.io.tmpdir=C:\DOCUME~1\A
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:java.compiler=<NA>
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:os.name=Windows XP
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:os.arch=x86
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:os.version=5.1
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:user.name=Administrator
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:user.home=C:\Documents and S
2011-06-02 16:04:31,156 - INFO  [main:Environment@97] - Server environment:user.dir=D:\WorkStation\Tale
2011-06-02 16:04:31,171 - INFO  [main:ZooKeeperServer@663] - tickTime set to 2000
2011-06-02 16:04:31,171 - INFO  [main:ZooKeeperServer@672] - minSessionTimeout set to -1
2011-06-02 16:04:31,171 - INFO  [main:ZooKeeperServer@681] - maxSessionTimeout set to -1
2011-06-02 16:04:31,234 - INFO  [main:NIOServerCnxn$Factory@143] - binding to port 0.0.0.0/0.0.0.0:2181
2011-06-02 16:04:31,250 - INFO  [main:FileTxnSnapLog@208] - Snapshotting: 0
```

Then startup the OSGi Container, for details on this please refer to ???. After the container has started, we need to deploy our bundles and start them. In addition to the above three bundles, we need to install and start another two bundles "org.talend.esb.locator" and "org.apache.zookeeper.zookeeper". Since our bundles are dependent on them, execute the following commands sequentially. (Note the bundle numbers returned with each osgi:install command will probably be different from those used in this sample; use those numbers instead.) Then all bundles will be installed and the environment is ready to test:

```
karaf@trun> osgi:install mvn:org.apache.zookeeper/zookeeper/3.3.3
karaf@trun> osgi:install mvn:org.talend.esb/locator/5.2.1
karaf@trun> osgi:install mvn:org.talend.esb.examples.locator/locator_common/1.0.0
karaf@trun> osgi:install mvn:org.talend.esb.examples.locator/locator_service/1.0.0
karaf@trun> osgi:install mvn:org.talend.esb.examples.locator/locator_client/1.0.0
karaf@trun> osgi:start 154
karaf@trun> osgi:start 155
karaf@trun> osgi:start 156
karaf@trun> osgi:start 157
```

Since we want to test the service, we'll leave the locator_client stopped. After executing "osgi:start 157", change to the ZooKeeper console, and you will some log messages like:

```
2011-06-02 16:17:02,031 - INFO
[NIOServerCxn.Factory:0.0.0.0/0.0.0.0:2181:NIOServerCnxn$Factory@251] -
Accepted socket connection from /127.0.0.1:1102
2011-06-02 16:17:02,031 - INFO
[NIOServerCxn.Factory:0.0.0.0/0.0.0.0:2181:NIOServerCnxn@777] - Client
attempting to establish new session at /127.0.0.1:1102
2011-06-02 16:17:02,046 - INFO
[SyncThread:0:NIOServerCnxn@1580] - Established session 0x1304f61dba10001
with negotiated timeout 5000 for client /127.0.0.1:1102
```

That means the locator_service tried to connect to the ZooKeeper. If successful, the service will be registered, then we can use the service.

If everything is OK, now, execute "osgi:start 158" on OSGi Container console, you can get some output message in the console:

```
karaf@trun> osgi:start 158
Executing operation greetMe
Message received: MyName

Hello MyName
```

If you get the message like this, then you did the right thing. Turn to zooKeeper console, you can see the connection message like below:

```
2011-06-02 16:24:19,671 - INFO
[NIOServerCxn.Factory:0.0.0.0/0.0.0.0:2181:NIOServerCnxn$Factory@251] -
Accepted socket connection from /127.0.0.1:1126
2011-06-02 16:24:19,671 - INFO
[NIOServerCxn.Factory:0.0.0.0/0.0.0.0:2181:NIOServerCnxn@777] - Client
attempting to establish new session at /127.0.0.1:1126
2011-06-02 16:24:19,703 - INFO
[SyncThread:0:NIOServerCnxn@1580] - Established session 0x1304f61dba10002
with negotiated timeout 5000 for client /127.0.0.1:1126
```

For more test, execute "osgi:stop 158" and the "osgi:start 158" on OSGi Container console. you can get the same result as we described above.

Thus far we showed you how to use Service Locator. In the next section we'll look into Service Activity Monitoring.

4.2. Service Activity Monitoring (SAM)

Service Activity Monitoring (SAM) allows you to log and/or monitor service calls done with the Apache CXF Framework. Typical use cases are usage statistics and fault monitoring. The solution consists of two parts: Agent (sam-agent) and Monitoring Server (sam-server). The Agent creates events out of the requests and replies on service consumer and provider side. The events are first collected locally and then sent to the monitoring server periodically to not disturb the normal message flow. The Monitoring Server receives events from the Agent, optionally filters/handlers events and stores them into a Database. The Agent is packaged as a JAR that needs to be on the classpath of the service consumer and provider. The Monitoring Server is deployed as a WAR in a servlet container and needs access to a database.

Let's look at how to use Service Activity Monitoring in Talend ESB.

4.2.1. Run the Monitoring Server

The Monitoring Server can be run on the Talend Runtime container or in an embedded Jetty server. We'll only cover the Talend Runtime container here. For more details about how to run it on Tomcat or Jetty, please see *Talend ESB Getting Started Guide*.

The Service Activity Monitoring configuration file is `<TalendRuntimePath>/container/etc/org.talend.esb.sam.server.cfg`. Please edit this file if you want to change the default values:

```
monitoringServiceUrl=/MonitoringServiceSOAP
db.driver=org.apache.derby.jdbc.ClientDriver
db.url=jdbc:derby://localhost:1527/db;create=true
db.username=test
db.password=test
db.incrementer=derbyIncrementer

db.recreate=true
db.createsql=create.sql
```

Then start the OSGi container by running **`<TalendRuntimePath>/container/bin/trun.bat`** on Windows or **`<TalendRuntimePath>/container/bin/trun`** on Linux. Once the OSGi Container is started, you can setup the server by executing the following commands on the OSGi Console:

```
features:install tesb-derby-starter
features:install tesb-sam-server
```

```
features:install tesb-sam-agent
```

The the Database, sam-server and sam-agent will be installed and are ready to used.

4.2.2. Prepare the sample

We'll reuse the sample from Section 2.2.3, "*Making SOAP calls with soapUI*".

In Section 2.1, "*Contract-first development*", in order to use the Service Locator, we knew that we needed to add a LocatorFeature. This time we need to add "org.talend.esb.sam.agent.feature.EventFeature".

We'll use a Spring configuration to do that. The simplest way is to copy the "beans.xml" from `examples/talend/tesb/samsam-example-osgi` to `src/main/resources/META-INF/spring/beans.xml` of this project. Below are the main contents:

```
<import resource="classpath:META-INF/cxf/cxf.xml"/>
<import resource="classpath:META-INF/tesb/agent-context.xml"/>
<context:annotation-config/>

<bean
    class="org.springframework.beans.factory.config.PropertyPlaceholderConfigurer">
    <property name="ignoreUnresolvablePlaceholders" value="true"/>
    <property name="location" value="classpath:agent.properties"/>
</bean>

<bean id="eventFeature" class="org.talend.esb.sam.agent.feature.EventFeature">
    <property name="mapper" ref="eventMapper"/>
    <property name="eventSender" ref="eventCollector"/>
    <property name="logMessageContent" value="${log.messageContent}"/>
</bean>

<bean id="eventMapper"
    class="org.talend.esb.sam.agent.eventproducer.MessageToEventMapperImpl">
    <property name="maxContentLength" value="${log.maxContentLength}"/>
</bean>

<bean id="eventCollector"
    class="org.talend.esb.sam.agent.collector.EventCollectorImpl" >
    <!-- Default interval for scheduler. Start every X millis a new scheduler -->
    <property name="defaultInterval" value="${collector.scheduler.interval}"/>
    <!-- Number of events within one service call. This is a maximum number.
        If there are events in the queue, the events will be processed. -->
    <property name="eventsPerMessageCall" value="${collector.maxEventsPerCall}"/>
    <property name="monitoringServiceClient" ref="monitoringServceV1Wrapper"/>
    <property name="executor" ref="defaultExecutor"/>
    <property name="scheduler" ref="defaultScheduler"/>
</bean>

<bean id="memoryQueue" class="java.util.concurrent.ConcurrentLinkedQueue"/>
<task:scheduler id="defaultScheduler" pool-size="2"/>
<task:executor id="defaultExecutor" pool-size="10"/>

<bean id="monitoringServceV1Wrapper"
    class="org.talend.esb.sam.agent.serviceclient.MonitoringServiceWrapper">
    <property name="monitoringService" ref="monitoringServiceV1Client"/>
    <!-- Number of retries Default: 5 -->
    <property name="numberOfRetries" value="${service.retry.number}"/>
    <!-- Delay in milliseconds between the next attemp to send.
        Thread is blocked during this time. Default: 1000 -->
    <property name="delayBetweenRetry" value="${service.retry.delay}"/>
```

```
</bean>

<bean id="fixedProperties"
    class="org.talend.esb.sam.common.handler.impl.CustomInfoHandler">
    <property name="customInfo">
        <map>
            <entry key="Application name" value="Service2"/>
        </map>
    </property>
</bean>

<jaxws:endpoint id="customerService" address="/CustomerServicePort"
    implementor="com.example.customerservice.CustomerServiceImpl">
    <jaxws:features>
        <ref bean="eventFeature"/>
    </jaxws:features>
</jaxws:endpoint>
```

And we also need to give an agent.properties file used to configure sam-agent:

```
collector.scheduler.interval=500
collector.maxEventsPerCall=10

log.messageContent=true
log.maxContentLength=-1

service.url=http://localhost:8040/services/MonitoringServiceSOAP
service.retry.number=3
service.retry.delay=5000
```

We can give a logging.properties file for logger:

```
handlers = java.util.logging.ConsoleHandler, java.util.logging.FileHandler

# Set the default logging level for the root logger
.level = INFO

# Set the default logging level for new ConsoleHandler instances
java.util.logging.ConsoleHandler.level = INFO

# Set the default logging level for new FileHandler instances
java.util.logging.FileHandler.level = ALL

# Set the default formatter for new ConsoleHandler instances
#java.util.logging.ConsoleHandler.formatter = java.util.logging.SimpleFormatter
java.util.logging.ConsoleHandler.formatter = //
    org.sopera.monitoring.util.CustomLogFormatter

# Set the default logging level for the logger named com.mycompany
#org.talend.esb.sam.level = FINE
#org.eclipse.persistence.level = INFO
org.talend.esb.sam.level = FINE
org.eclipse.persistence.level = WARNING
```

We also need to change pom.xml to add more dependencies and plugins:

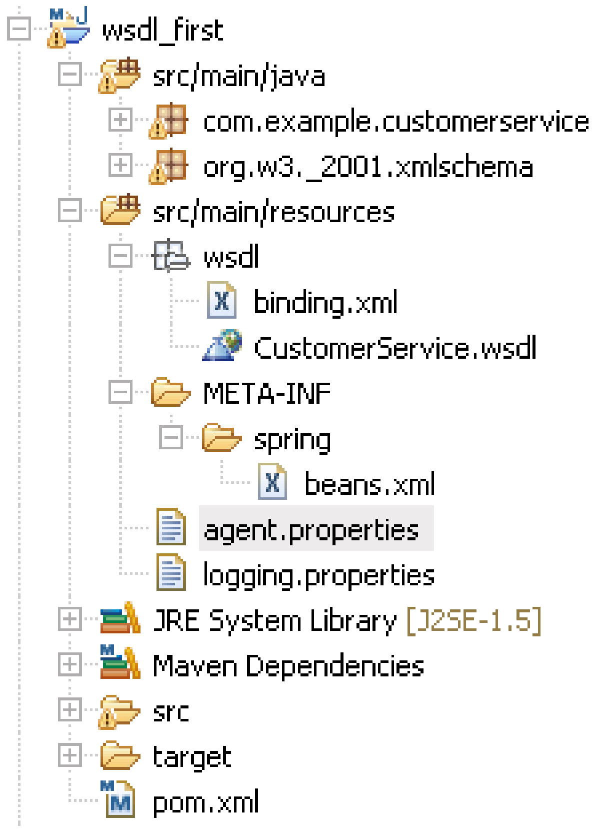
Add a dependency for sam-agent:

```
<dependency>
    <groupId>org.talend.esb</groupId>
    <artifactId>sam-agent</artifactId>
    <version>5.2.1</version>
</dependency>
```

Change the configuration of maven-bundle-plugin as following:

```
<plugin>
    <groupId>org.apache.felix</groupId>
    <artifactId>maven-bundle-plugin</artifactId>
    <extensions>true</extensions>
    <version>2.3.7</version>
    <configuration>
        <instructions>
            <Bundle-SymbolicName>
                ${pom.groupId}.${pom.artifactId}
            </Bundle-SymbolicName>
            <Bundle-Name>${pom.name}</Bundle-Name>
            <Bundle-Version>${pom.version}</Bundle-Version>
            <Export-Package>
                com.example.customerservice
            </Export-Package>
            <Bundle-Activator>
                com.example.customerservice.Activator
            </Bundle-Activator>
            <Require-Bundle>
                org.apache.cxf.bundle;version="2.6.0",
                org.apache.cxf.bundle,
                org.springframework.beans,
                org.springframework.context,
                sam-agent
            </Require-Bundle>
        </instructions>
    </configuration>
</plugin>
```

Now the project structure is:



```
wsdl_first
    src/main/java
        com.example.customerservice
        org.w3._2001.xmlschema
    src/main/resources
        wsdl
            binding.xml
            CustomerService.wsdl
        META-INF
            spring
                beans.xml
        agent.properties
        logging.properties
    JRE System Library [J2SE-1.5]
    Maven Dependencies
    src
    target
    pom.xml
```

We finished our configuration, now let's install and deploy it into the OSGi Container, as described in previous chapters.

4.2.3. Test SAM Server

Thus far, we have deployed it, so it can now be tested.

For testing, we can use the sam-example-client in the Talend ESB examples.

The file agent.properties:

```
collector.scheduler.interval=500
collector.maxEventsPerCall=10

log.messageContent=true
log.maxContentLength=-1

service.url=http://localhost:8040/services/MonitoringServiceSOAP
service.retry.number=3
service.retry.delay=5000
```

Spring configuration file contents:

```
<import resource="classpath:META-INF/cxf/cxf.xml" />
<import resource="classpath:META-INF/cxf/cxf-extension-soap.xml" />
<import resource="classpath:META-INF/cxf/cxf-servlet.xml" />

<import resource="classpath:META-INF/tesb/agent-context.xml" />

<bean id="fixedProperties"
    class="org.talend.esb.sam.common.handler.impl.CustomInfoHandler">
    <property name="customInfo">
        <map>
            <entry key="Application name" value="Client" />
        </map>
    </property>
</bean>

<bean class="org.talend.esb.sam.examples.client.CustomerServiceTester">
    <property name="customerService" ref="customerService" />
</bean>

<jaxws:client id="customerService"
    address="${serviceUrl}"
    serviceClass="com.example.customerservice.CustomerService">
    <jaxws:features>
        <!-- <bean class="org.apache.cxf.feature.LoggingFeature" />-->
        <ref bean="eventFeature"/>
    </jaxws:features>
</jaxws:client>
```

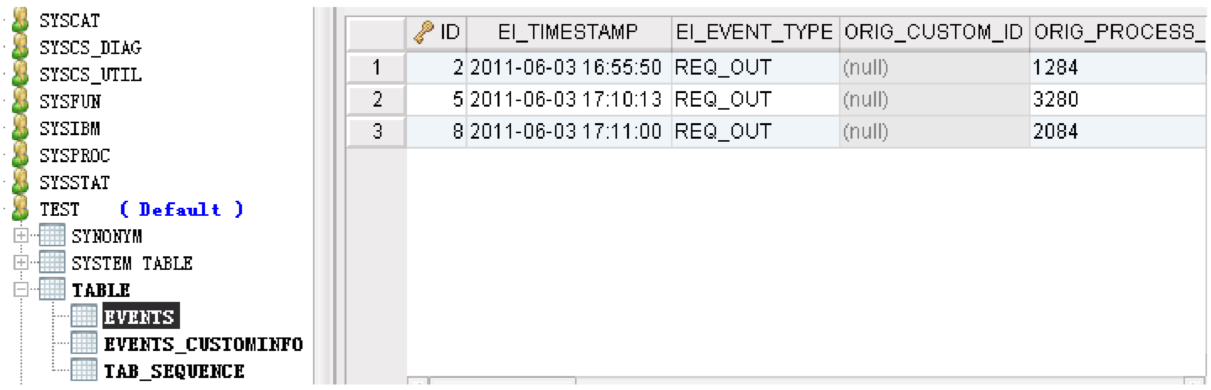
Then provide the following code:

```
// read configuration
System.setProperty("serviceUrl",
    "http://localhost:9090/CustomerServicePort/CustomerServiceService");
ClassPathXmlApplicationContext context =
    new ClassPathXmlApplicationContext("/client.xml");
CustomerServiceTester tester = context.getBean(CustomerServiceTester.class);
tester.testCustomerService();
```

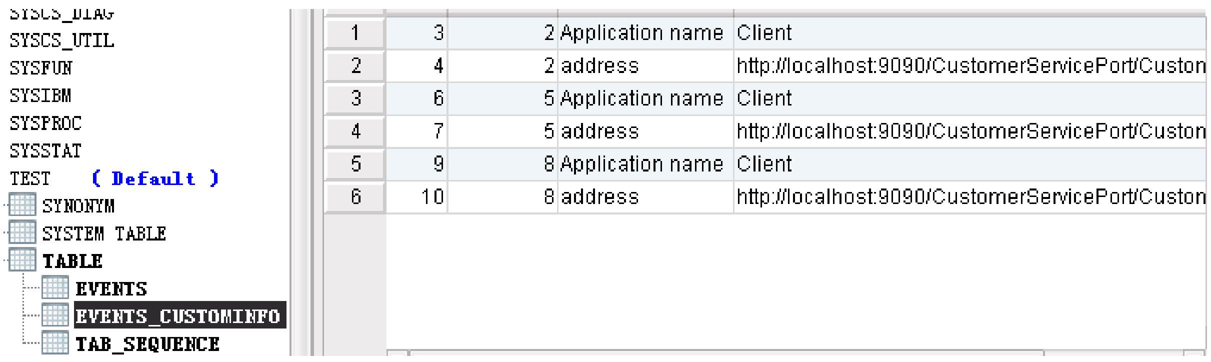
As you see we sent the value of "serviceUrl" with service URL, which will fill the contents of bean "customerService". Now we'll turn to the CustomerServiceTester to do a real test:

```
public void testCustomerService() throws NoSuchCustomerException {
    List<Customer> customers = null;

    // First we test the positive case where customers are found and we retrieve
    // a list of customers
    System.out.println("Sending request for customers named Smith");
    customers = customerService.getCustomersByName("Smith");
    System.out.println("Response received");
    Assert.assertEquals(2, customers.size());
    Assert.assertEquals("Smith", customers.get(0).getName());
    try {
        Thread.sleep(1000);
    } catch (InterruptedException e1) {
    }
    // Then we test for an unknown Customer name
    // and expect a NoSuchCustomerException
    try {
        customers = customerService.getCustomersByName("None");
        Assert.fail("We should get a NoSuchCustomerException here");
    } catch (NoSuchCustomerException e) {
        System.out.println(e.getMessage());
        Assert.assertNotNull("FaultInfo must not be null", e.getFaultInfo());
        Assert.assertEquals("None", e.getFaultInfo().getCustomerName());
        System.out.println("NoSuchCustomer exception was received as expected");
    }

    System.out.println("All calls were successful");
}
```

As you can see, we did some testing by requesting a customer. Every time a test is executed, a log message will be recorded into the database we configured in "org.talend.esb.sam.server.cfg". A database viewer can be used to confirm that, for example DbVisualizer:



	ID	EI_TIMESTAMP	EI_EVENT_TYPE	ORIG_CUSTOM_ID	ORIG_PROCESS_
1	2	2011-06-03 16:55:50	REQ_OUT	(null)	1284
2	5	2011-06-03 17:10:13	REQ_OUT	(null)	3280
3	8	2011-06-03 17:11:00	REQ_OUT	(null)	2084



1	3	2	Application name	Client
2	4	2	address	http://localhost:9090/CustomerServicePort/Custon
3	6	5	Application name	Client
4	7	5	address	http://localhost:9090/CustomerServicePort/Custon
5	9	8	Application name	Client
6	10	8	address	http://localhost:9090/CustomerServicePort/Custon