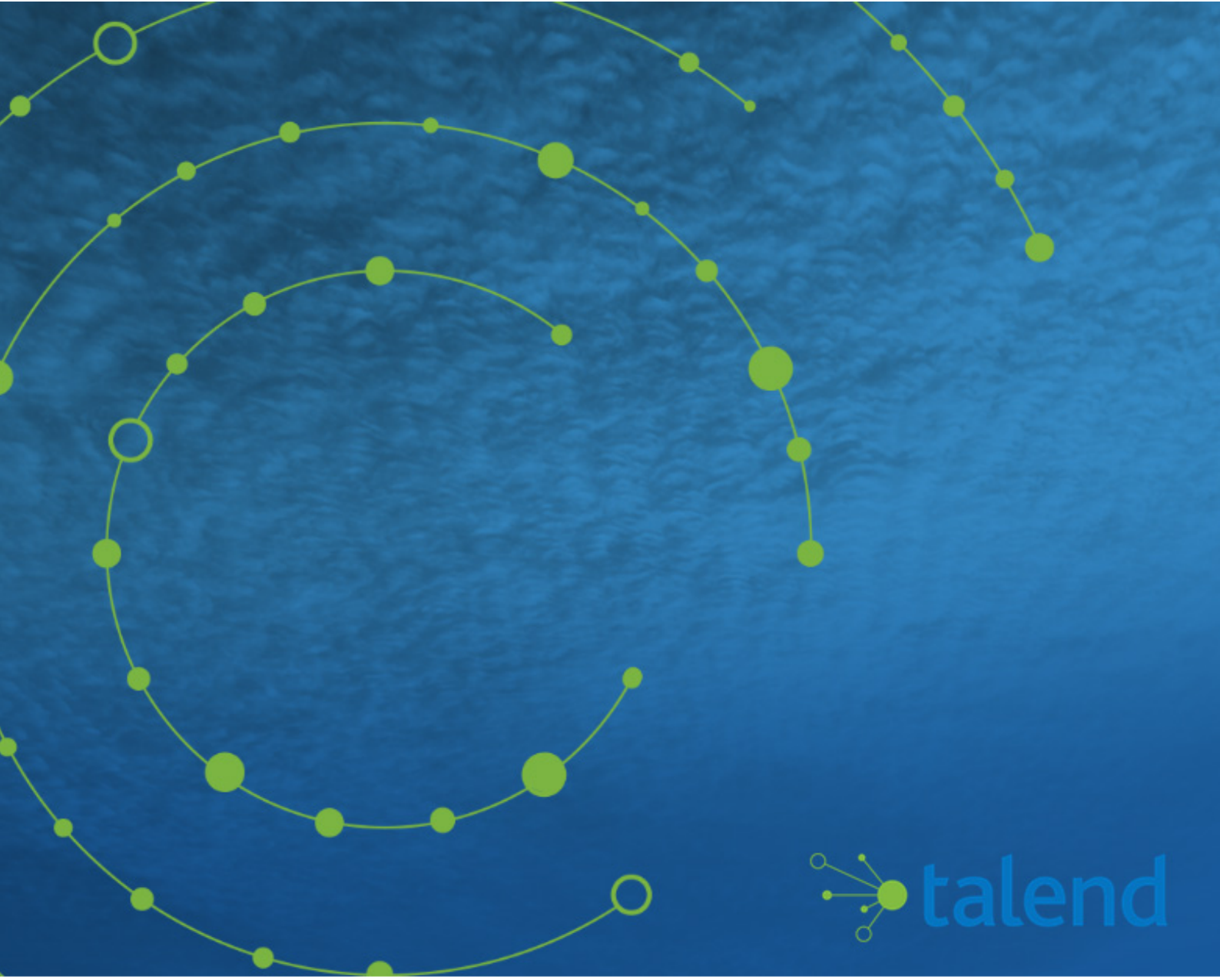

Talend ESB

Development Guide

7.0.1

Adapted for v7.0.1. Supersedes previous releases.

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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 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 *Web Services*, and then we'll explore Camel development in *Camel Routes Overview*. Finally, developing with Talend ESB specific services such as Service Activity Monitoring and the Service Locator is covered in *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 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 be 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.:

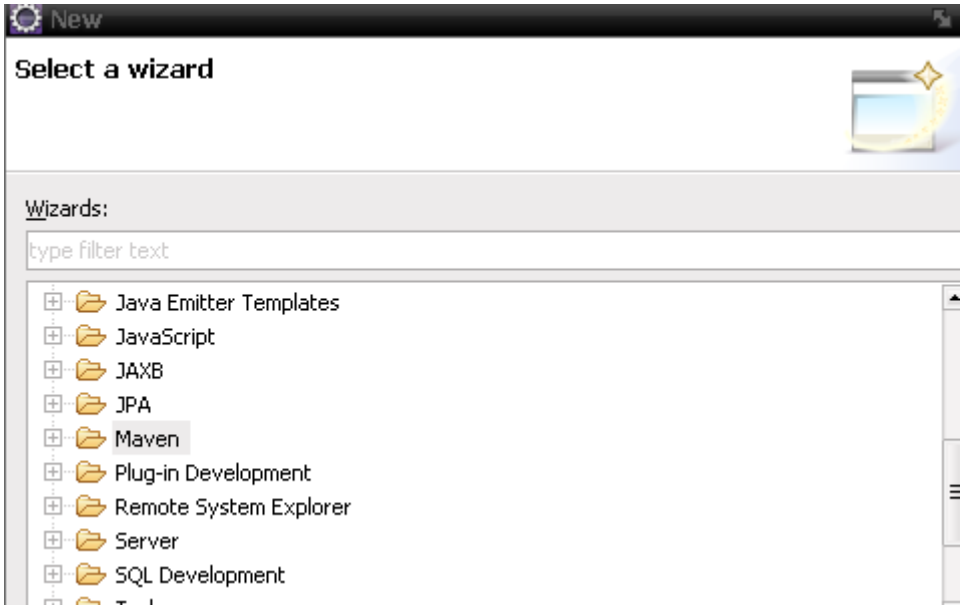
```
<servers>
   <server>
      <id>myTomcat</id>
      <username>tomcat</username>
      <password>tomcat</password>
   </server>
   ... other server configurations ...
</servers>
```

  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.

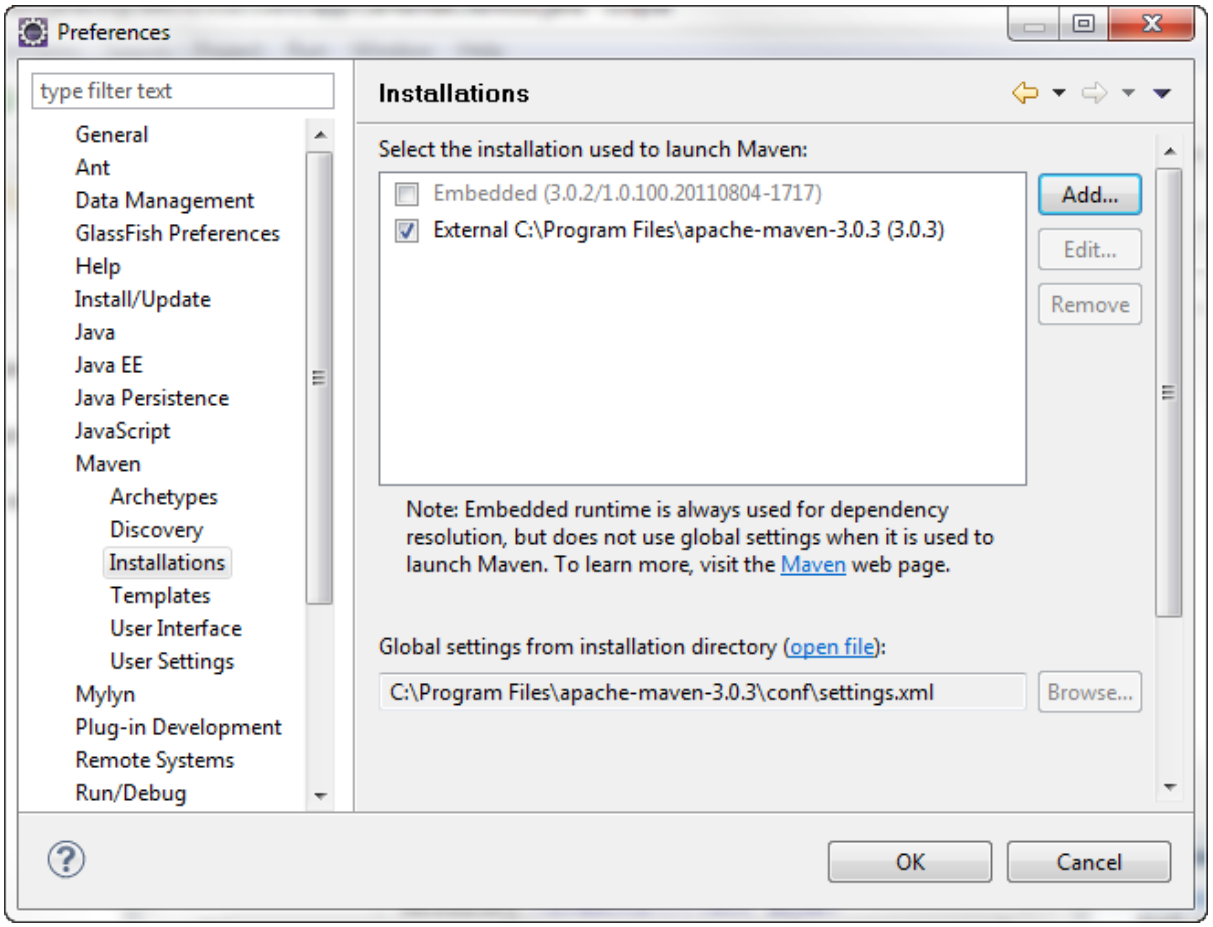
- Next let's test your Maven installation. Run **`mvn version`** from any command-line prompt. You should see Maven respond providing the Maven version you downloaded, the JDK version, and various other associated information.

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. The Talend 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:



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. The Talend 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 *Contract-first development*, *Code-first development* and *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 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/talend/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 Runtime 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 Runtime 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/talend/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.Top-level pom.xml

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>7.0.1-SNAPSHOT</version>
    <name>Dev Guide Tutorial: WSDL-First Web Service</name>
    <packaging>pom</packaging>

    <!-- Dev Guide examples kept standalone (i.e., do not
         reach back to examples' parent POM) for tutorial
         purposes.
    -->

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

    <properties>
        <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
```

```
        <cxf.version>3.2.4</cxf.version>
        <spring.version>4.3.14.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>
            <plugin>
               <groupId>org.apache.tomcat.maven</groupId>
               <artifactId>tomcat7-maven-plugin</artifactId>
               <version>2.1</version>
               <configuration>
                  <server>myTomcat</server>
                  <url>http://localhost:8080/manager/text</url>
                  <path>/${project.build.finalName}</path>
               </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" 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>
    <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>7.0.1-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>
                                        ${basedir}/src/main/resources/
DoubleIt.wsdl
                                    </wsdl>
                                    <wsdlLocation>classpath:DoubleIt.wsdl</
wsdlLocation>
                                </wsdlOption>
                            </wsdlOptions>
                        </configuration>
                        <goals>
                            <goal>wsdl2java</goal>
                        </goals>
                    </execution>
                </executions>
            </plugin>
            <plugin>
                <groupId>org.apache.felix</groupId>
                <artifactId>maven-bundle-plugin</artifactId>
                <version>2.4.0</version>
                <extensions>true</extensions>
                <configuration>
                    <instructions>
                        <Bundle-SymbolicName>${project.artifactId}</Bundle-
SymbolicName>
                        <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" 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>
    <artifactId>dev-guide-wsdl-first-war</artifactId>
    <name>-- Service WAR file</name>
    <packaging>war</packaging>
    <url>http://maven.apache.org</url>

    <parent>
```

```
        <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
        <artifactId>dev-guide-wsdl-first</artifactId>
        <version>7.0.1-SNAPSHOT</version>
    </parent>

    <dependencies>
        <dependency>
            <groupId>org.talend.cxf-examples.dev-guide-wsdl-first</groupId>
            <artifactId>dev-guide-wsdl-first-service</artifactId>
            <version>7.0.1-SNAPSHOT</version>
        </dependency>
        <dependency>
            <groupId>org.springframework</groupId>
            <artifactId>spring-web</artifactId>
            <version>${spring.version}</version>
        </dependency>
    </dependencies>

    <build>
        <plugins>
            <plugin>
               <groupId>org.apache.tomcat.maven</groupId>
               <artifactId>tomcat7-maven-plugin</artifactId>
            </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" 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>
```

```
    <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>7.0.1-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>7.0.1-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:

   ```
   Hit '<tab>' for a list of available commands
   and '[cmd] --help' for help on a specific command.
   Hit '<ctrl-d>' or type 'system:shutdown' or 'logout' to shutdown 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/7.0.1
   ```

   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 **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 Container Administration Guide*.

2.1.6.2. Tomcat (WAR archive)

Make sure you've configured Tomcat and Maven as discussed in *Download Tomcat 7.x (optional)* and *Download Maven 3*, and that you've updated the soap:address element in the WSDL as discussed in *Creating the WSDL*. If so, starting Tomcat and running **mvn tomcat7: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/talend/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>
```

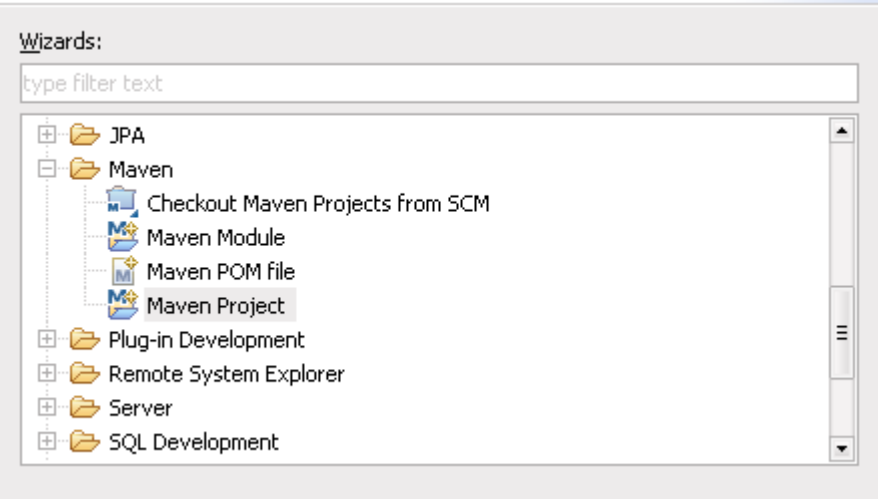
This sample can be compiled and deployed just as explained in the previous wsdl-first example--only difference, for Talend ESB OSGi deployment, to use **install mvn:org.talend.cxf-examples.dev-guide-java-first/dev-guide-java-first-service/7.0.1** as the bundle install string.

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.

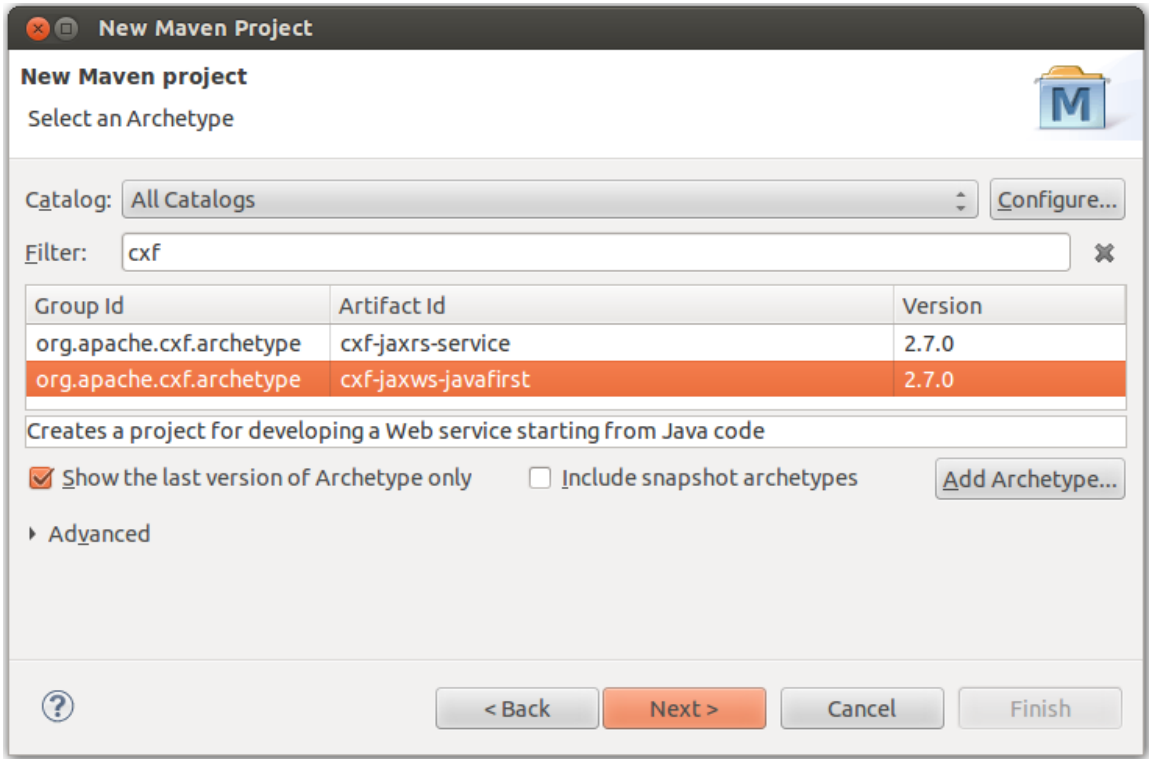
2.2.1. CXF Maven Archetypes

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:



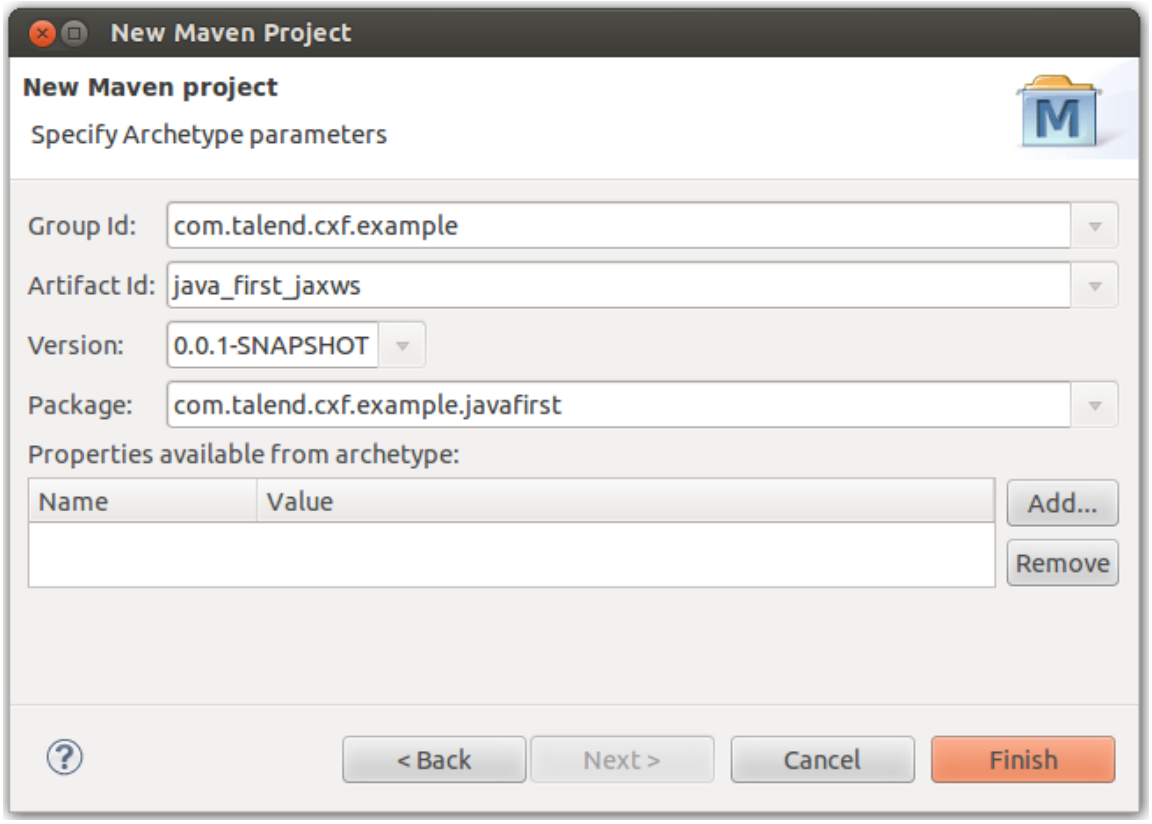
2. Click Next to get the "Select project name and location" screen, accept its defaults, and click Next again to get to the "Select an Archetype" dialog. On this page, enter "cxf" in the Filter box and select the item with group ID of `org.apache.cxf.archetype` and artifact ID of `cxf-jaxws-javafirst`:



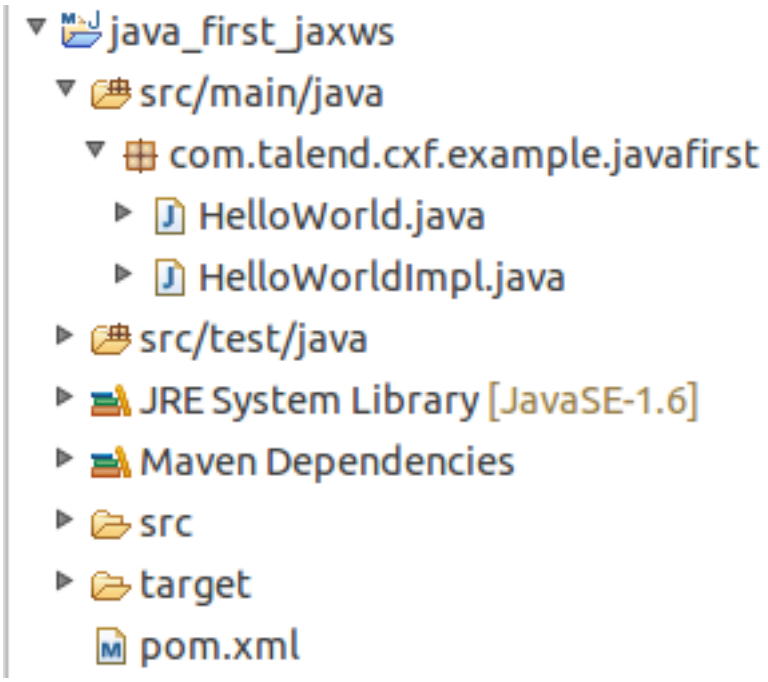
If the CXF archetype is not already available in your Eclipse installation, add it by selecting Add Archetype... with the following information:

- 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:



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



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 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 *Talend ESB (OSGi)* except with an install command of:

```
install mvn:com.talend.cxf.example/java_first_jaxws/0.0.1-SNAPSHOT
```

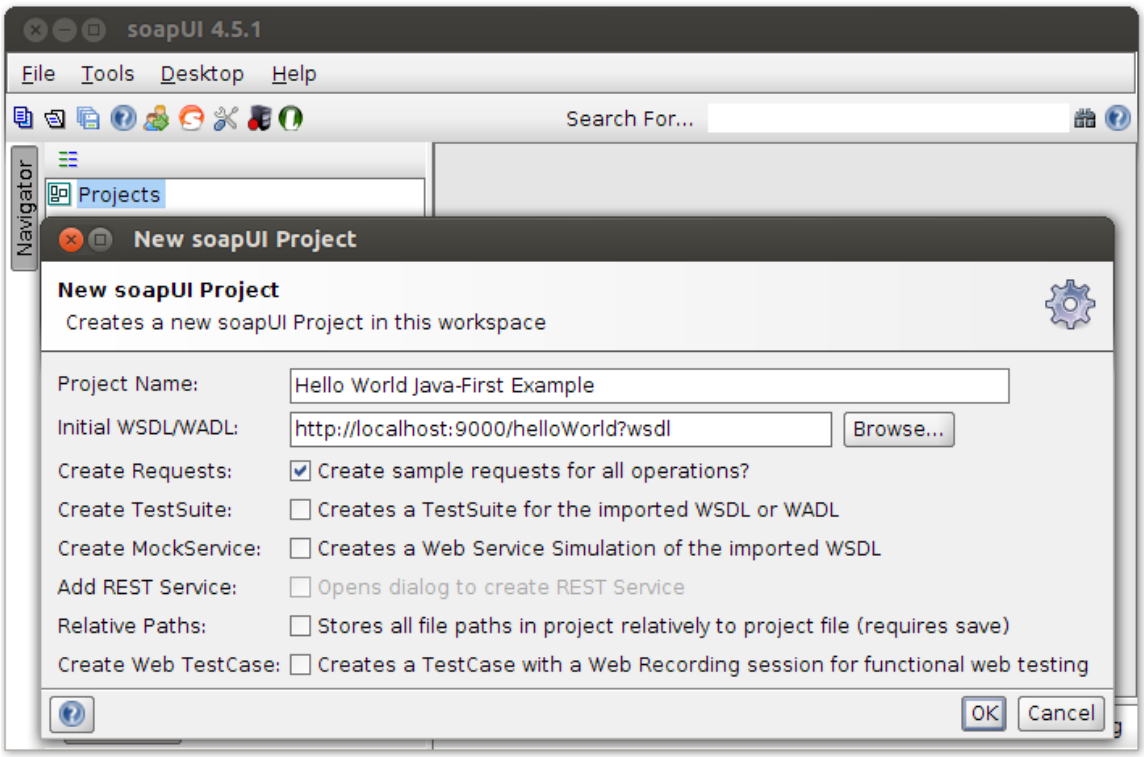
Run the **list** command to make sure the bundle has started (check the logfiles in `container/log folder` for any errors if not) and ensure you can see the service WSDL at `http://localhost:9000/helloWorld?wsdl`. If so, we're ready to make SOAP calls to the service using soapUI as shown in the next section.

2.2.3. Making SOAP calls with soapUI

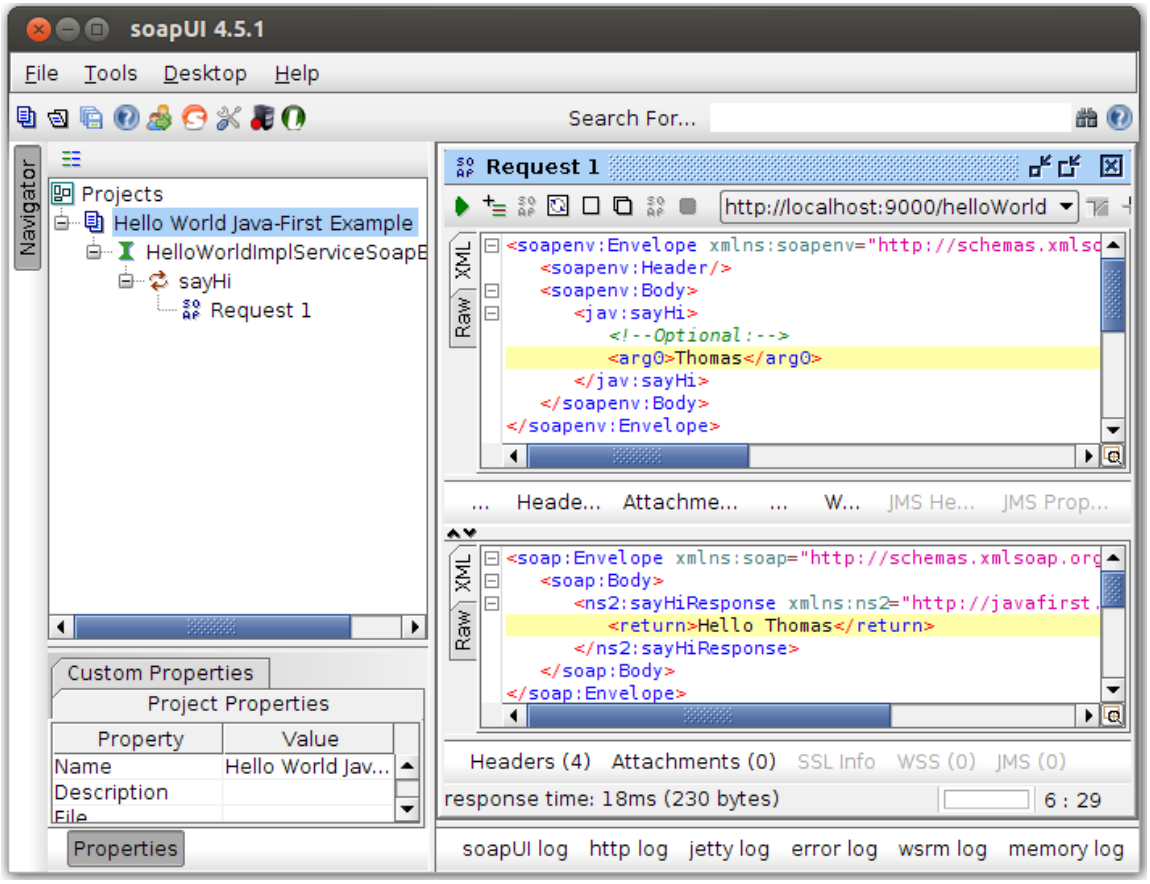
In this section we'll use soapUI to make SOAP calls to the Talend ESB-hosted web service created in the previous section. SoapUI's detailed tutorial is recommended for a full understanding of this tool's capabilities.

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.



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:



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 Runtime 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.

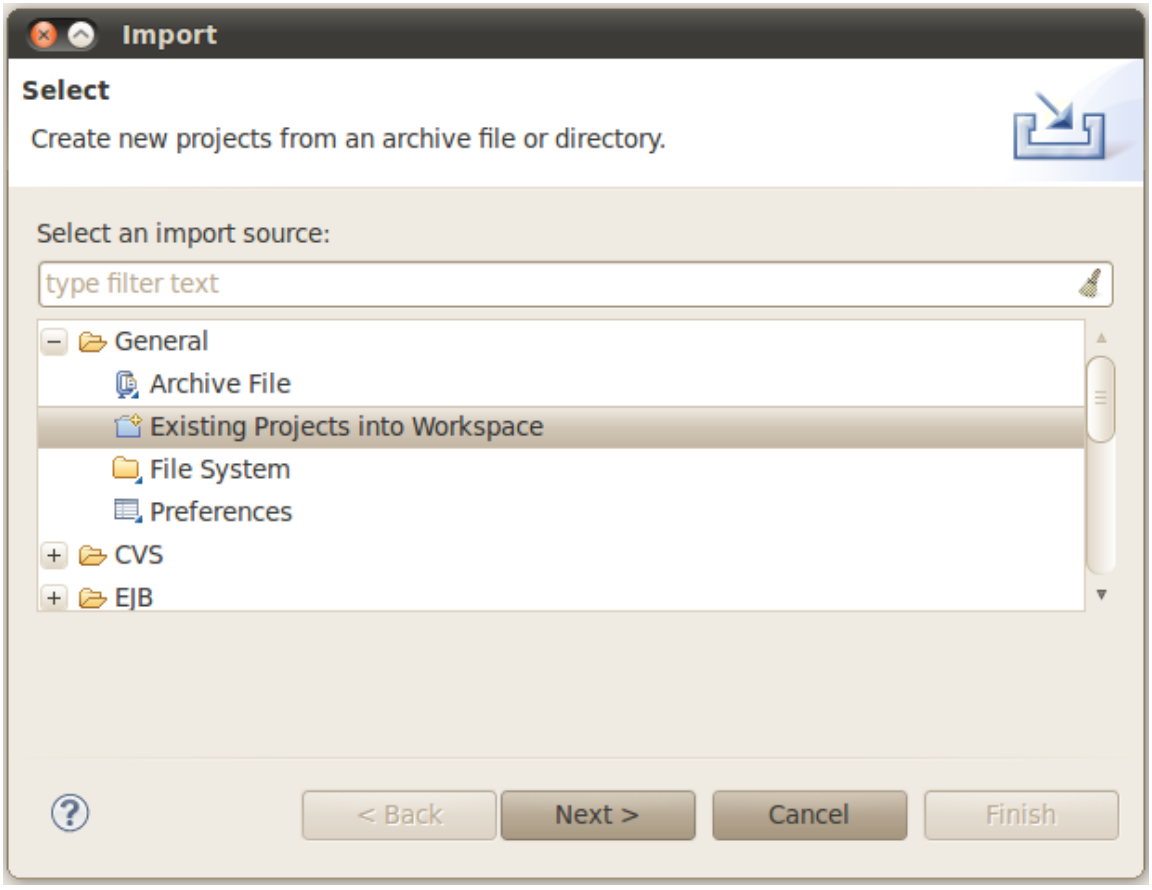
This sample consists of four subfolders:

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 **feature:repo-add mvn:com.talend.sf.examples/osgi/1.0/xml/features** to install the features file followed by **feature: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**.

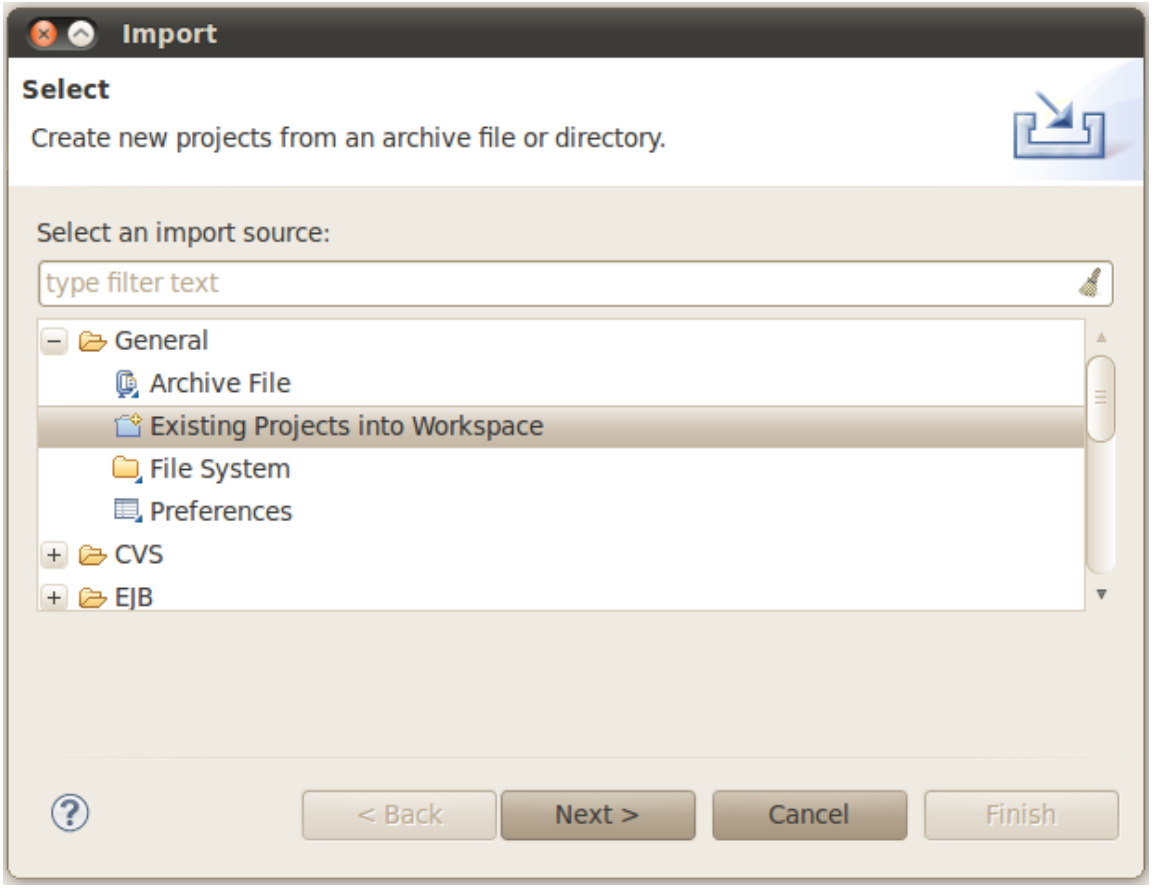
5. To run the client, from a command prompt in the jaxrs-intro/client folder, run **mvn exec:java**.

Chapter 3. Camel Routes Overview

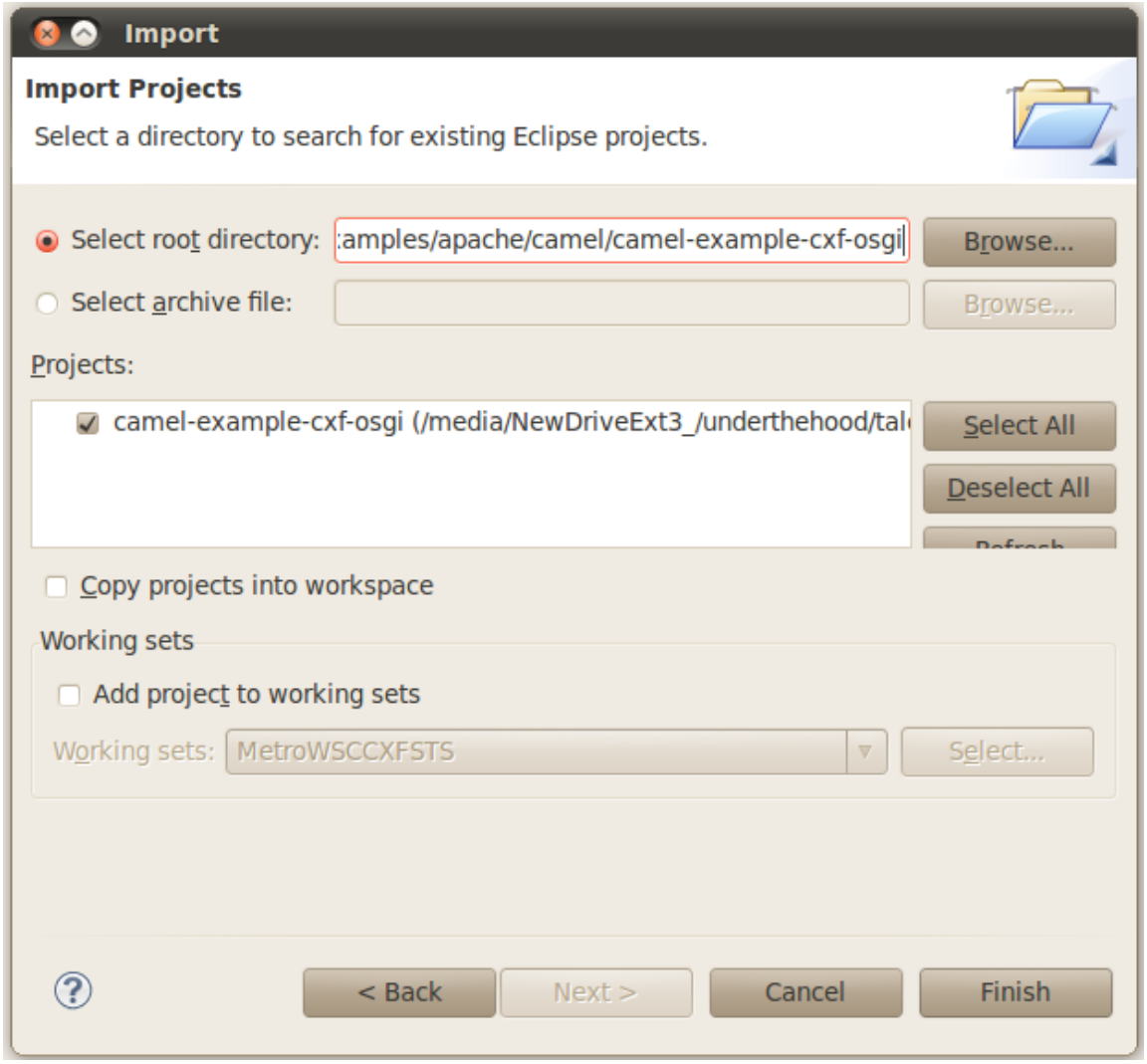
To demonstrate the usage and deployment of a Camel route within Talend ESB using Eclipse, we'll use Camel's `camel-example-cxf-osgi` example, located within the `examples/apache/camel` folder of the Talend ESB distribution. Steps:

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.)

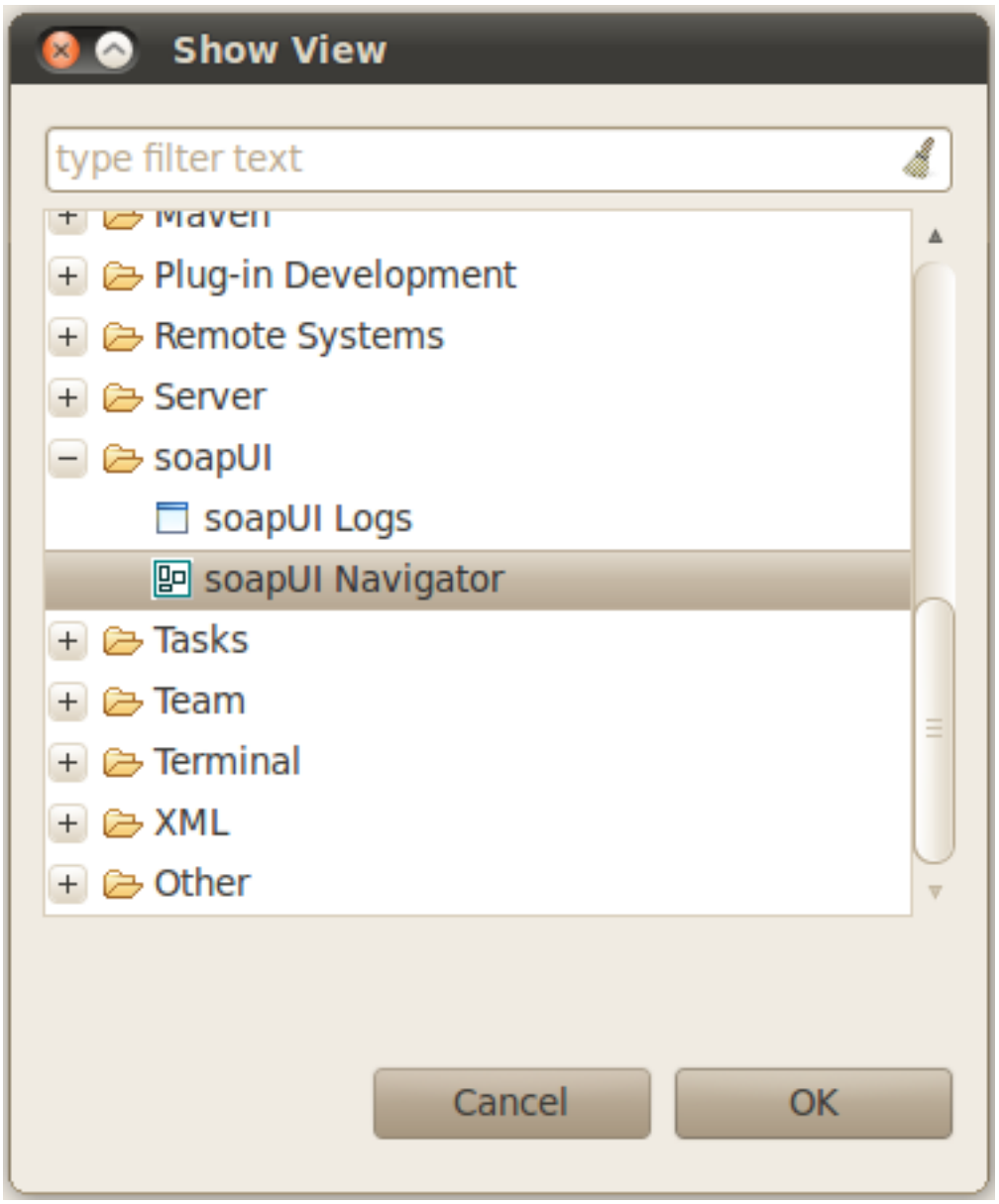


4. As this example runs in the Talend Runtime container, we'll need to start the container prior to running this example. Navigate to the `<TalendRuntimePath>/container/bin` folder and enter **trun.bat** or **./trun**. Enter the following commands at the resulting console to install the example:

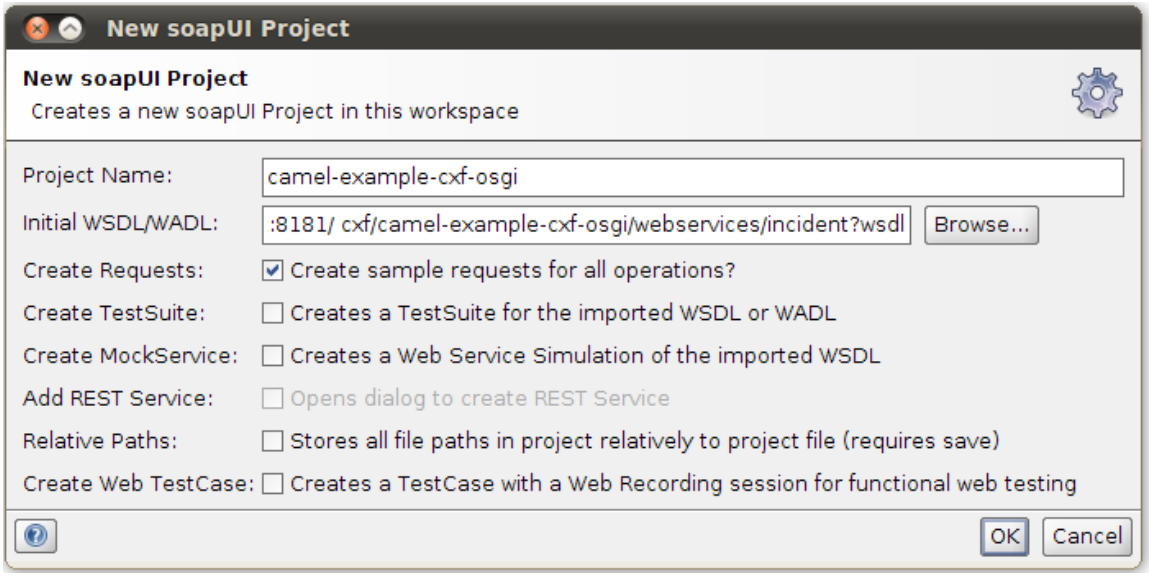
```
feature:repo-add mvn:org.apache.camel.karaf/apache-camel/2.10.2/xml/features
feature:install war
feature:install camel-spring
feature:install camel-jaxb
feature:install camel-cxf
bundle:install -s mvn:org.apache.camel/camel-example-cxf-osgi/2.10.2
```

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 *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`



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 chapter looks at accessing the Talend ESB services: Service Locator and Service Activity Monitoring from an Eclipse development environment.

For more details on these services, please see *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. Zookeeper can be used either in standalone, therefore it is located within the Talend ESB distribution at `<TalendRuntimePath>/zookeeper` or as an OSGi feature in the Talend Runtime container. 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.

In this section, you learn how to use the Service Locator via a simple greeting example.

4.1.1. Using the Service Locator in non-OSGi environments

If you are using a standard Web application Server (like Tomcat) with ESB JAX-WS based Services, the client component of the Service Locator (locator-<7.0.1>.jar) is needed to enable your CXF service or consumer to use the Service Locator. Add this JAR to the classpath or WAR file as appropriate.

4.1.2. Service interface

Within Eclipse:

1. Create a Maven project, following the same steps as *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.

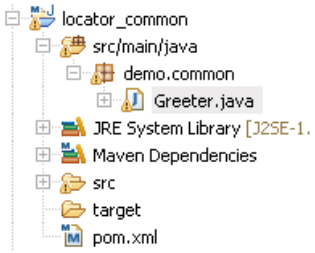
3. Create a package named "demo.common", and create an interface `Greeter.java`:

```
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 you will need to edit the `pom.xml`. (Please refer to *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>
```

5. Now that you have 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.

   The next step is to implement of this service.

4.1.3. Service implementation

1. Create a "locator_service" project first, following the steps as above.

2. Create a `GreeterImpl.java` which implements the Greeter interface defined above.

   The content of GreeterImpl.java is:

```
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.

   This is where the Service Locator becomes useful, because as mentioned at the beginning of this section, the Service Locator is a mechanism to discover service endpoints at runtime.

3. In order to make the Implementation discoverable, you need to register it first.

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

   - For Spring configuration:

     The Locator feature is enabled by declaring instances of its classes in the Spring configuration file: `<import resource="classpath:META-INF/tesb/locator/beans.xml" />`.

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

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

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

And to add the Locator feature to a CXF service provider, use the `<jaxws:features>` including the `org.talend.esb.servicelocator.cxf.LocatorFeature`.

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

- 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();
```

4. Similar to *Service Locator*, 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 is all the code you need to provide.

5. Configure the `pom.xml`, add the necessary dependencies, and configure the exported bundle information.

Finally, the content of `pom.xml` is:

```
<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></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>7.0.1</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=""
                    </Require-Bundle>
                </instructions>
            </configuration>
        </plugin>
    </plugins>
</build>
```

6. Install it into Maven by running **Maven Install**.

   Now the Service interface is defined, and implemented. It is time to write a client which will consume the service.

4.1.4. Service Consumer

This time, you will try to consume the service above by using Service Locator instead of referencing the implementor directly. As for the service registration, you can use Spring configuration or code directly.

1. To make the consumer discoverable:

   - For Spring configuration:

     The Locator feature is enabled by declaring instances of its classes in the Spring configuration file: `<import resource="classpath:META-INF/tesb/locator/beans.xml" />`.

```
<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.xml" />

    <jaxws:client id="greeterService" address="locator://
more_useful_information"
        serviceClass="demo.common.Greeter">
```

```
        <jaxws:features>
            <ref bean="locatorFeature"/>
        </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 is that you must use the locator protocol for client `address="locator://more_useful_information"`.

2. As you will export the project as an OSGi bundle, so you will 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 {
    }
}
```

3. Configure the `pom.xml` with the following content:

```
<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></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>${cxf.version}</version>
    </dependency>
    <dependency>
        <groupId>org.talend.esb</groupId>
        <artifactId>locator</artifactId>
        <version>7.0.1</version>
    </dependency>
    <dependency>
        <groupId>${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>
```

4. Execute **Run As > Maven Install** to install this bundle. So far, you have finished all bundles, now you will see how to install them and also combine them with Service Locator.

4.1.5. ZooKeeper usage

You can use Service Locator either by using the standalone Zookeeper provided in the Talend ESB product, or by using its OSGi Bundles equivalent already installed in the Talend Runtime container.

Service Locator standalone installation

1. Go into `<TalendRuntimePath>/zookeeper`.

2. Before starting Zookeeper, you need to provide a configuration file. Two configuration files are provided: `<TalendRuntimePath>/zookeeper/conf/zoo.cfg`, the default one, and `zoo_sample.cfg`. For a testing purpose, if you do not want to edit the default file, you can just rename the `zoo_sample.cfg` to `zoo.cfg`.

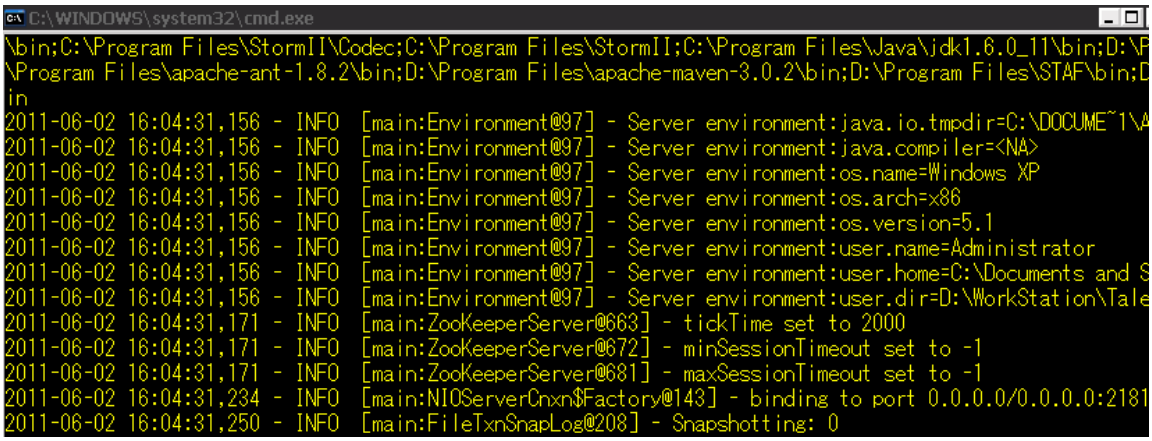
   Edit it and change the settings as follows:

   ```
   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.
   - The `clientPort` number should be same as the `endpointPrefix` defined in LocatorFeature above.

3. Once the `zoo.cfg` file configured, you can start or stop the zooKeeper by running:

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



4. Start the Container, for details on this please refer to *Talend ESB (OSGi)*.

Service Locator installation as an OSGi bundle

1. You first need to start the Talend Runtime container and start the Service Locator feature via the **tesb:start-locator**. For more information on how to start them, see the *Talend ESB Infrastructure Services Configuration Guide*.

2. Once the Service Locator feature started, a `container/etc/org.talend.esb.locator.server.cfg` configuration file is created. It is the Talend ESB equivalent to the Zookeeper `zoo.cfg` configuration file.

Edit it and change the settings as follows:

```
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.
- The `clientPort` number should be same as the `endpointPrefix` defined in LocatorFeature above.

3. Restart the Container.

Service deployment

Now that the Service Locator has been installed successfully in the Talend Runtime container, you will deploy the services.

1.
   - If you installed Zookeeper in standalone, you first need to install and start two bundles: "org.talend.esb.locator" and "org.apache.zookeeper.zookeeper" that activate the Service Locator feature in the Talend Runtime container. And then, you can deploy the three bundles you previously created and start them. To do so, execute the following commands sequentially:

     ```
     karaf@trun> bundle:install mvn:org.apache.zookeeper/zookeeper/3.3.3
     karaf@trun> bundle:install mvn:org.talend.esb/locator/7.0.1
     karaf@trun> bundle:install mvn:org.talend.esb.examples.locator/
     locator_common/1.0.0
     karaf@trun> bundle:install mvn:org.talend.esb.examples.locator/
     locator_service/1.0.0
     karaf@trun> bundle:install mvn:org.talend.esb.examples.locator/
     locator_client/1.0.0
     karaf@trun> bundle:start 154
     karaf@trun> bundle:start 155
     karaf@trun> bundle:start 156
     karaf@trun> bundle:start 157
     ```

   - If you installed Zookeeper as an OSGi bundle, you will only need to deploy the three bundles you previously created and start them:

     ```
     karaf@trun> bundle:install mvn:org.talend.esb.examples.locator/
     locator_common/1.0.0
     karaf@trun> bundle:install mvn:org.talend.esb.examples.locator/
     locator_service/1.0.0
     karaf@trun> bundle:install mvn:org.talend.esb.examples.locator/
     locator_client/1.0.0
     karaf@trun> bundle:start 156
     karaf@trun> bundle:start 157
     ```

   The bundle numbers returned for each `bundle: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. Except "locator_client", we need to keep it stopped for the time being.

2. After executing `bundle:start 157`:

   - If you installed Zookeeper in standalone, change to the ZooKeeper console, and you will see 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
     ```

   - If you installed Zookeeper as an OSGi bundle, execute the console command `list` and all the installed and started bundles should be listed and to check that the services are working, go to: `http://localhost:8040/services/`.

3. After installation has been done either in standalone or as an OSGi bundle and the service started and working, execute `bundle:start 158` on the Container console, you should get some output message in the console:

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

   Hello MyName
   ```

   If you get a message like this, then you did the right thing.

4. Turn to zooKeeper console (if you are using it as standalone), 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
   ```

5. For more test, execute `bundle:stop 158` and the `bundle:start 158` on OSGi Container console, you will have the same result as described above.

   So far, you saw how to use Service Locator. In the next section, you will look into Service Activity Monitoring.

4.1.6. Service Locator for RESTful services

The Service Locator feature can be used for both SOAP and RESTful Web Services.

The Service Locator configuration for Web services using the REST architectural style is similiar to the SOAP services configuration as described in previous sections.

To add the Locator feature to a RESTful service provider, use `<jaxrs:features>` including the `org.talend.esb.servicelocator.cxf.LocatorFeature` as below:

```
<reference id="locatorFeature"
 interface="org.talend.esb.servicelocator.cxf.LocatorFeature" />

<bean id="orderService" class="demo.service.OrderServiceImpl" />

<jaxrs:server id="orderRESTService" address="/rest">
    <jaxrs:features>
        <ref component-id="locatorFeature" />
    </jaxrs:features>
    <jaxrs:serviceBeans>
        <ref bean="orderService" />
    </jaxrs:serviceBeans>
</jaxrs:server>
```

To add the Locator feature to a CXF service consumer, use `<jaxrs:client>` including the `org.talend.esb.servicelocator.cxf.LocatorFeature` as below:

```
<reference id="locatorFeature"
 interface="org.talend.esb.servicelocator.cxf.LocatorFeature" />

<bean id="orderService" class="demo.service.OrderServiceImpl" />

<jaxrs:client id="restClient"
    address="locator://some_useful_information"
    serviceClass="demo.common.OrderService"
    xmlns:serviceNamespace="http://service.demo/"
    serviceName="serviceNamespace:OrderServiceImpl"
    inheritHeaders="true">
    <jaxrs:headers>
        <entry key="Accept" value="application/xml"/>
    </jaxrs:headers>
    <jaxrs:features>
        <ref component-id="locatorFeature" />
    </jaxrs:features>
</jaxrs:client>
```

As shown in the example above, `<jaxrs:client>` was configured by setting the `serviceName` attribute. You need this service name to discover the endpoint from the Locator server. Please note the `serviceName` attribute specifies a service `QName`, here `xmlns:serviceNamespace="http://service.demo/" serviceName="serviceNamespace:OrderServiceImpl"`

The `locator` protocol in the `address` attribute is used to enable the Locator feature.

4.2. Service Activity Monitoring

Service Activity Monitoring 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.

In the section you will learn 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, but only the Talend Runtime container way is covered here.

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:

```
feature:install tesb-derby-starter
feature:install tesb-sam-server
feature:install tesb-sam-agent
```

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

4.2.2. Prepare the sample

Reuse the sample from *Making SOAP calls with soapUI*.

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

To do this, use a Spring configuration. The simplest way is to copy the "beans.xml" from `examples/talend/tesb/sam/sam-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:client id="customerService" address="/CustomerServicePort"
    implementor="com.example.customerservice.CustomerServiceImpl">
    <jaxws:features>
        <ref bean="eventFeature"/>
    </jaxws:features>
</jaxws:client>
```

And you 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
```

You 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
```

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

Add a dependency for sam-agent:

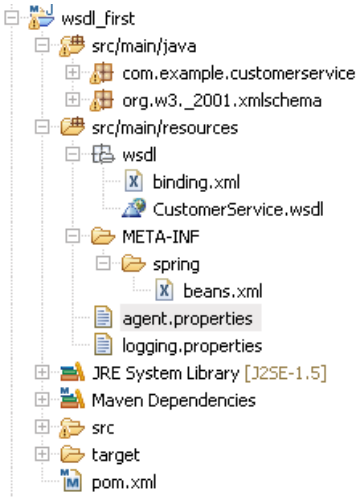
```
<dependency>
    <groupId>org.talend.esb</groupId>
    <artifactId>sam-agent</artifactId>
    <version>7.0.1</version>
</dependency>
```

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="",
                org.apache.cxf.bundle,
                org.springframework.beans,
                org.springframework.context,
                sam-agent
            </Require-Bundle>
        </instructions>
    </configuration>
</plugin>
```

Now the project structure is:



The configuration is finished, now install and deploy it into the OSGi Container, as described in previous chapters.

4.2.3. Test SAM Server

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

For testing, you 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, the value of "serviceUrl" is sent with service URL, which will fill the contents of bean "customerService". Now you willl 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, the test consisted in requesting a customer. Every time a test is executed, a log message will be recorded into the database you configured in "org.talend.esb.sam.server.cfg". A database viewer can be used to confirm that, for example DbVisualizer: