Developing JAX-RPC Web services

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This tutorial will take you through the steps required in developing, deploying and testing a Web Service in Apache Geronimo. After completing this tutorial you should be able to understand how to develop simple JAX-RPC compliant Web services in Apache Geronimo using Eclipse development environment. We also wont be focusing very much on developing client for JAX-RPC services as the client stubs generated are very close to that of JAX-WS.

JAX-WS Web Services
If you are new to Web Services, it is strongly recommended that you use JAX-WS 2.0 instead of JAX-RPC. JAX-WS 2.0 comes with many new features not supported by JAX-RPC.
Theoretically JAX-RPC maps to J2EE 1.4 whereas JAX-WS maps to Java EE 5. So JAX-WS leverages the full potential of annotations and other new features which simplifies the application development a lot.
Migrating from JAX-RPC to JAX-WS
If you are looking for how to migrate from JAX-RPC to JAX-WS, refer the following tutorial Migrating from JAX-RPC to JAX-WS.
The above tutorial does not go into details on why these changes are required and the concepts behind it, it is rather a quick note that helps you to deal with migrating your application from the older web service stack to new stack.

To run this tutorial, as a minimum you will be required to have installed the following prerequisite software.

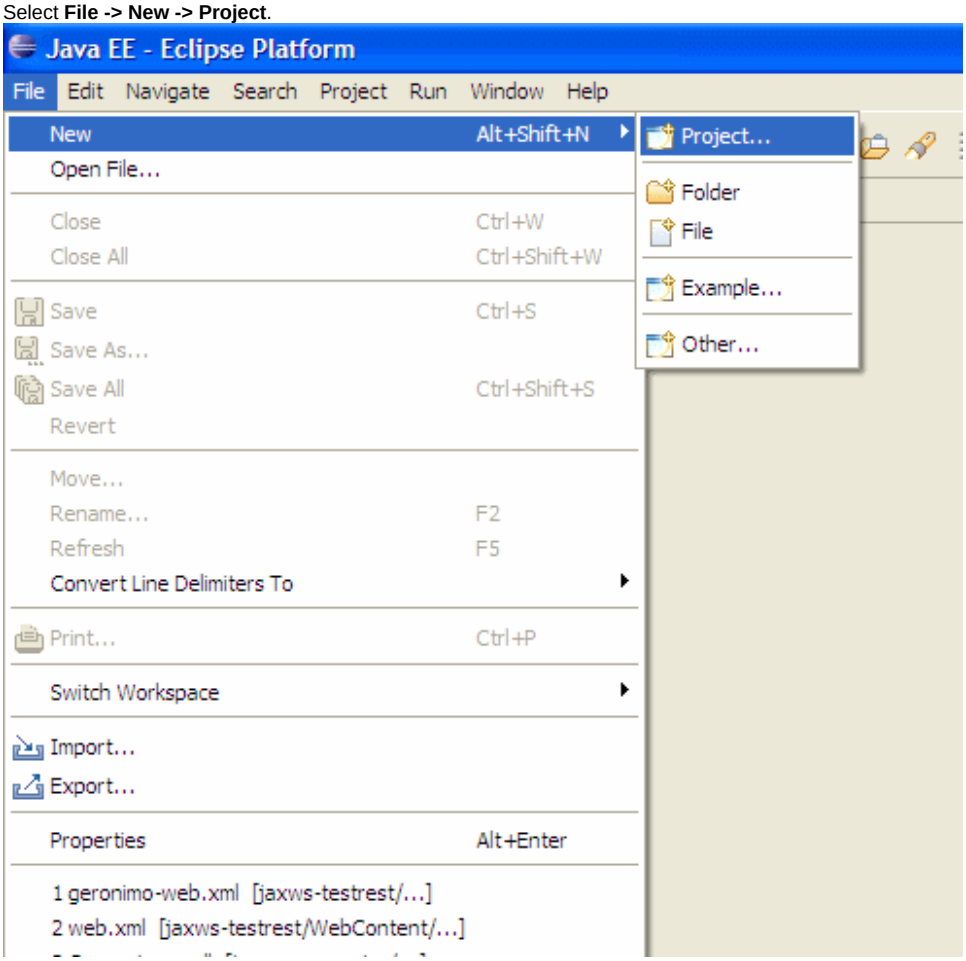
1. Sun JDK 6.0+ (J2SE 1.6)
2. Eclipse IDE for Java EE Developers, which is platform specific
3. Apache Geronimo Eclipse Plugin 2.1.x
4. Apache Geronimo Server 2.1.x
   Geronimo version 2.1.x, Java 1.5 runtime, and Eclipse Ganymede are used is used in this tutorial but other versions can be used instead (e.g., Geronimo version 2.2, Java 1.6, Eclipse Europa)

Details on installing eclipse are provided in the Development environment section. This tutorial will take you through the following steps:

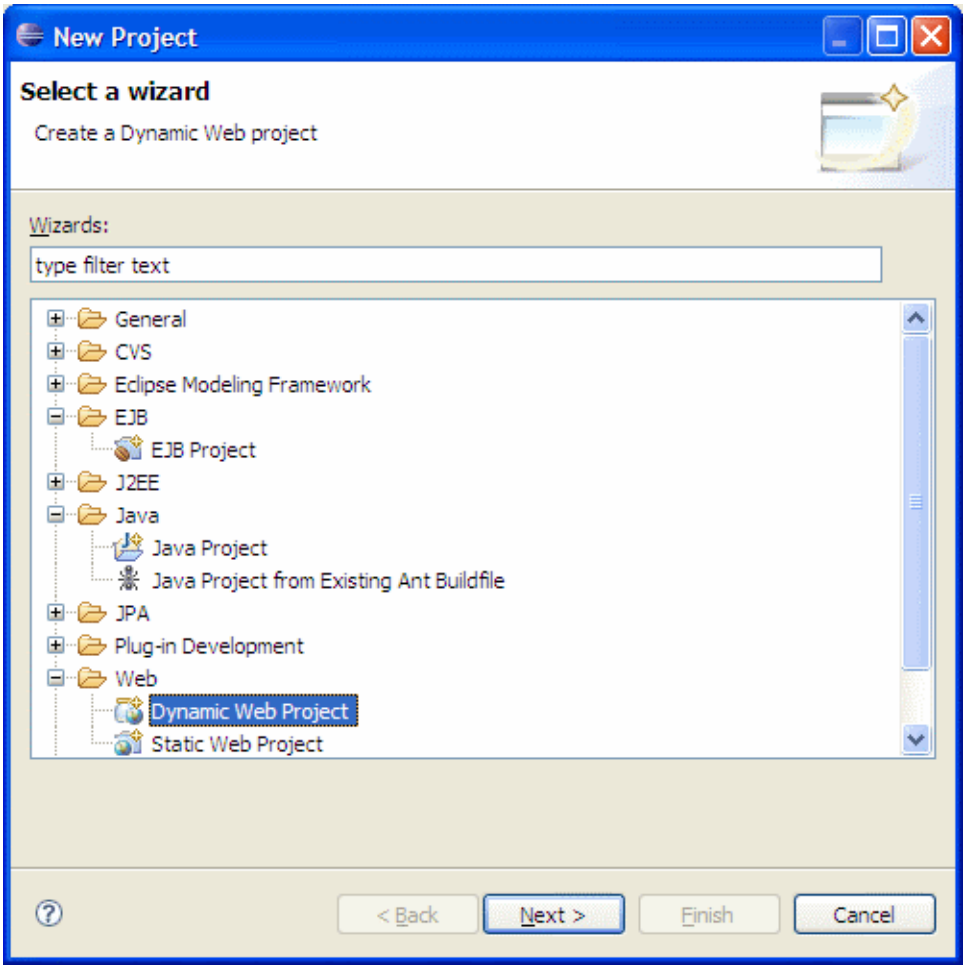
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Setting up Eclipse for application development

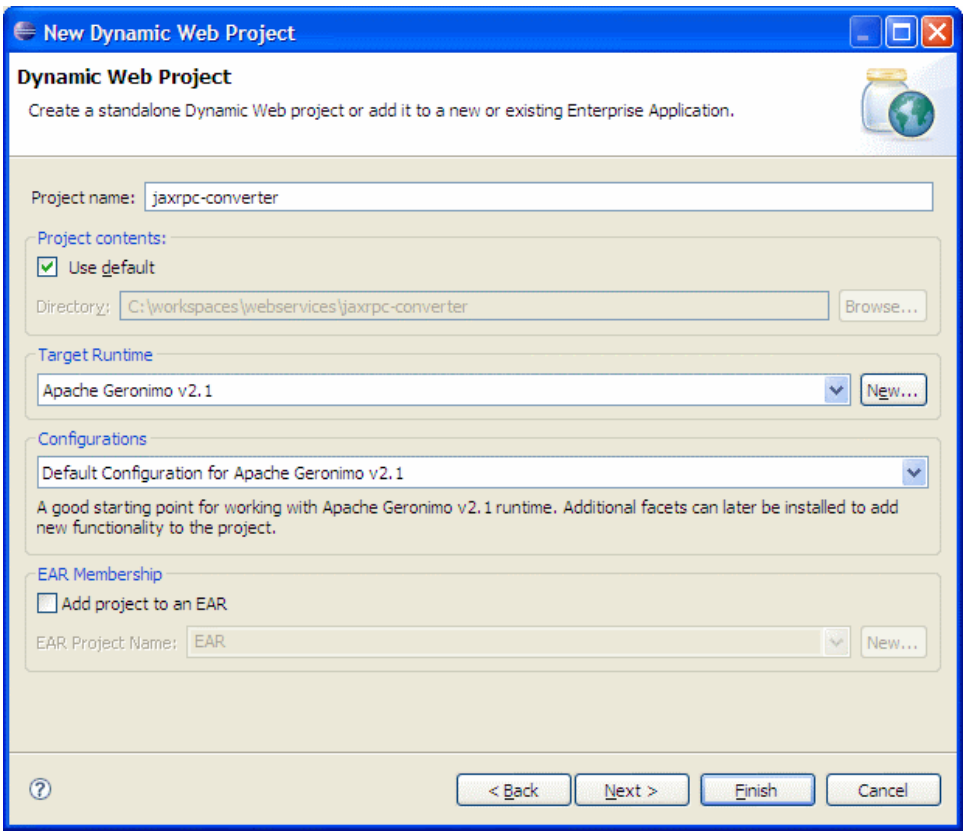
1. Select **File -> New -> Project**.



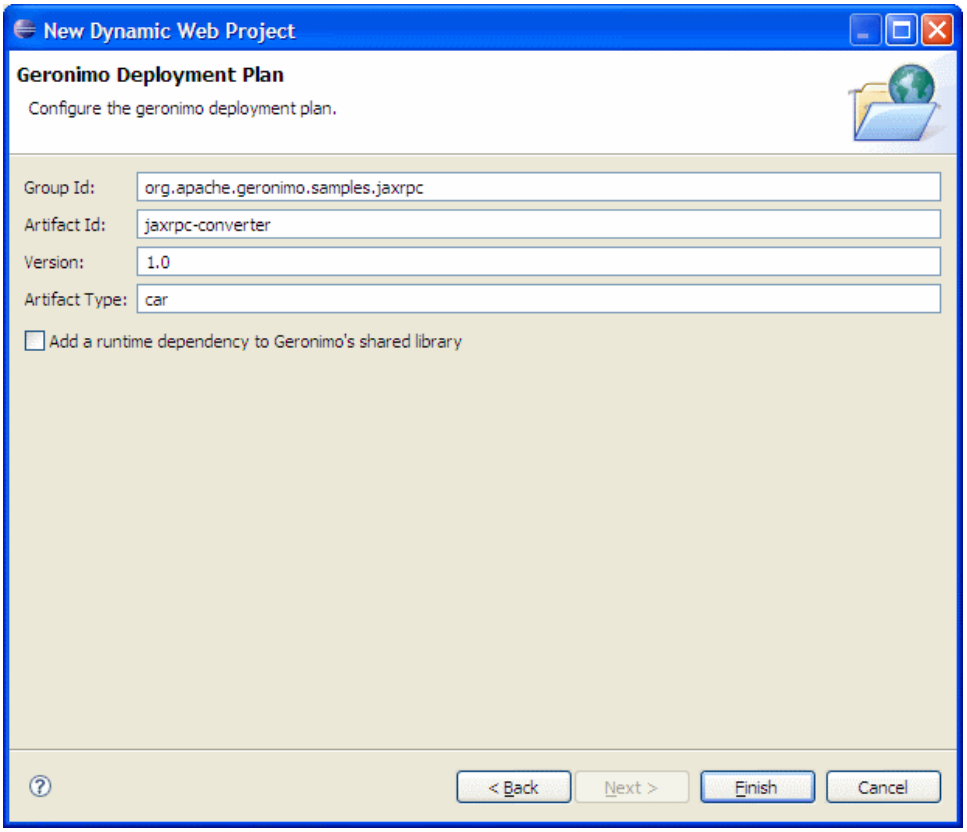
2. In the popup window, Select **Web -> Dynamic Web Project** category and click **Next**



3. Type *jaxrpc-converter* as the **Project Name** and click **Next** two times.



4. Modify the *Group Id* to *org.apache.geronimo.samples.jaxrpc* and the *artifact id* to *jaxrpc-converter*.

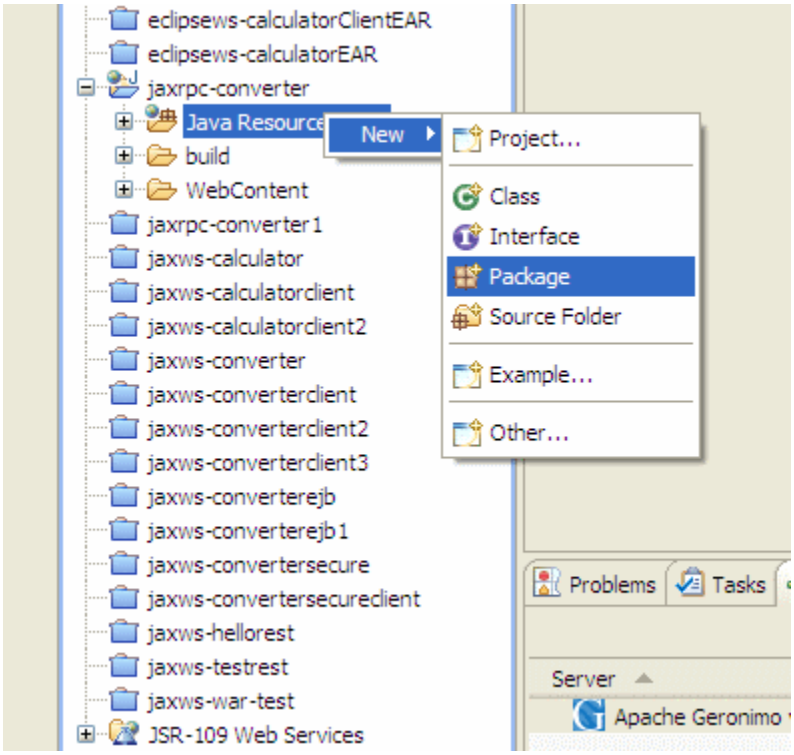


5. Click **Finish**.

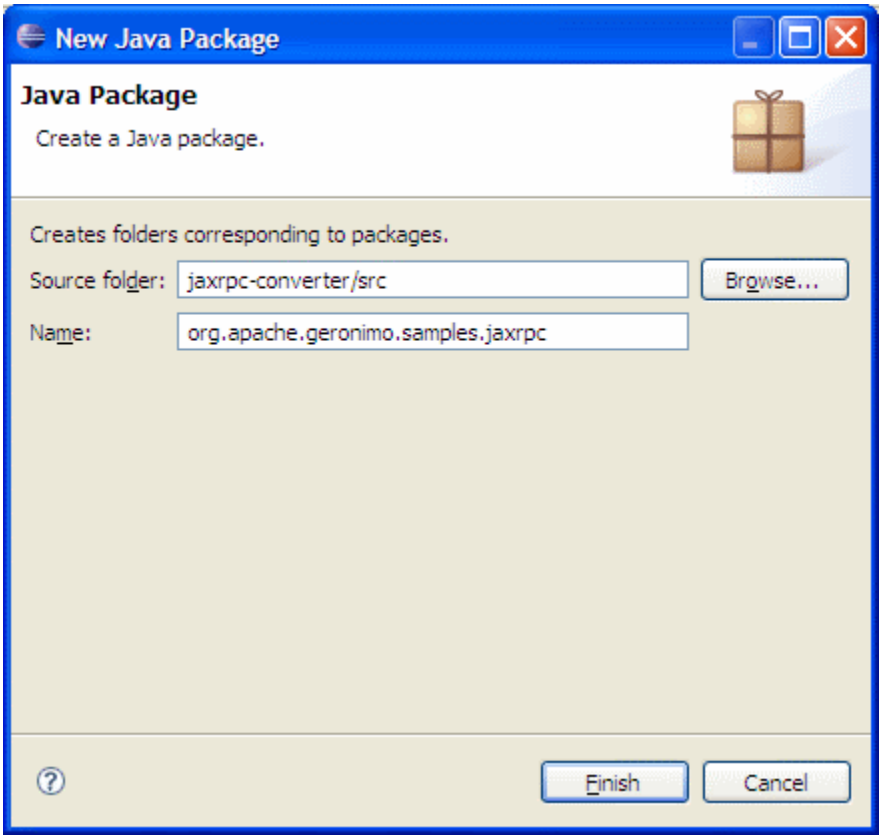
This completes the configuration of Eclipse for application development.

Creating the Web services implementation code

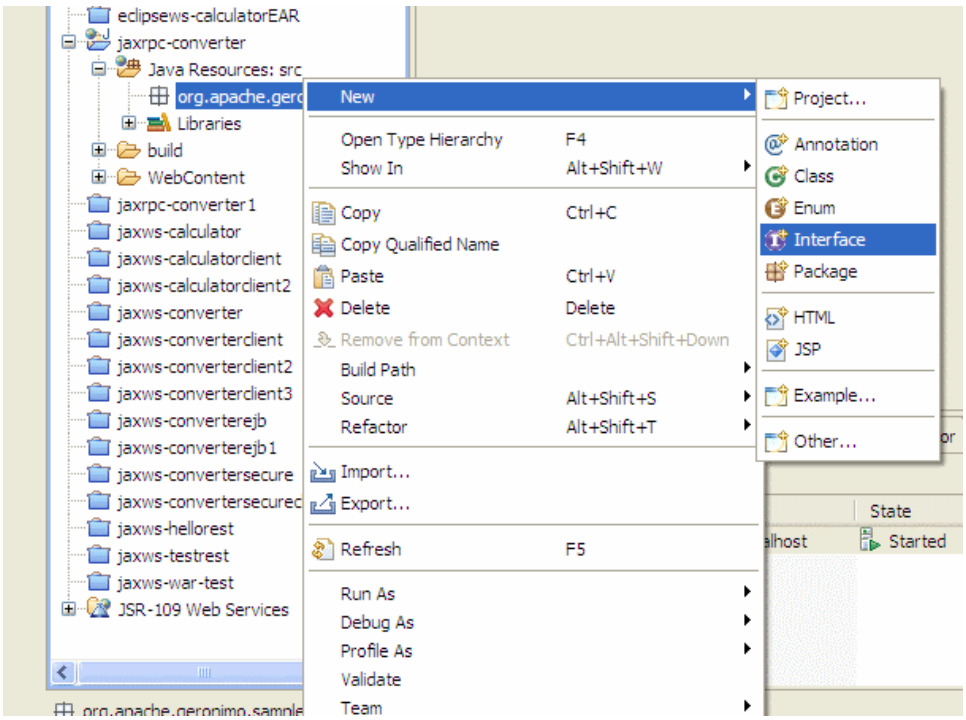
1. Right click on **JavaRsources:src** and select **New -> Package**.



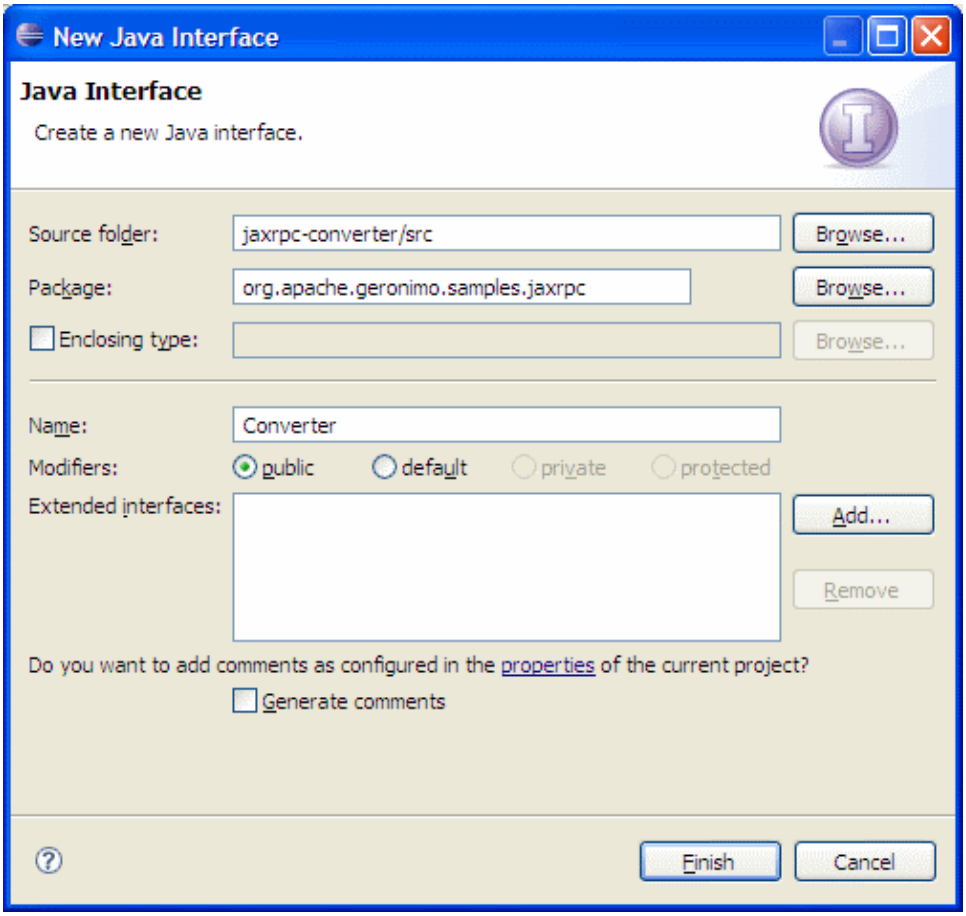
2. Name the package to *org.apache.geronimo.samples.jaxrpc* and click **Finish**.



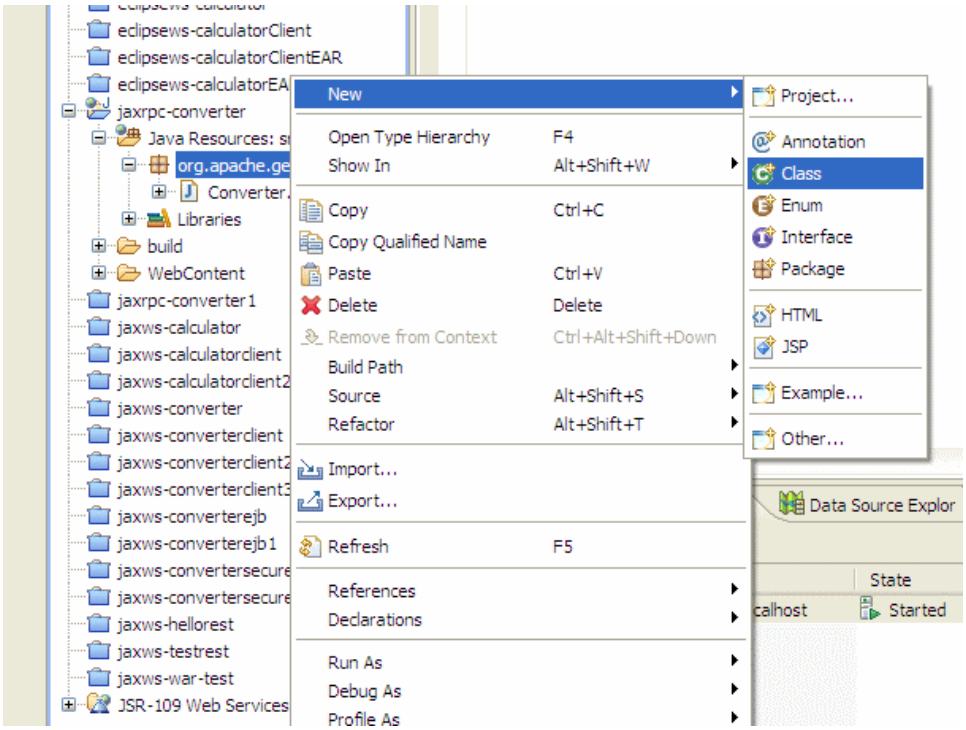
3. Right click on the new package and select **New -> Interface**.



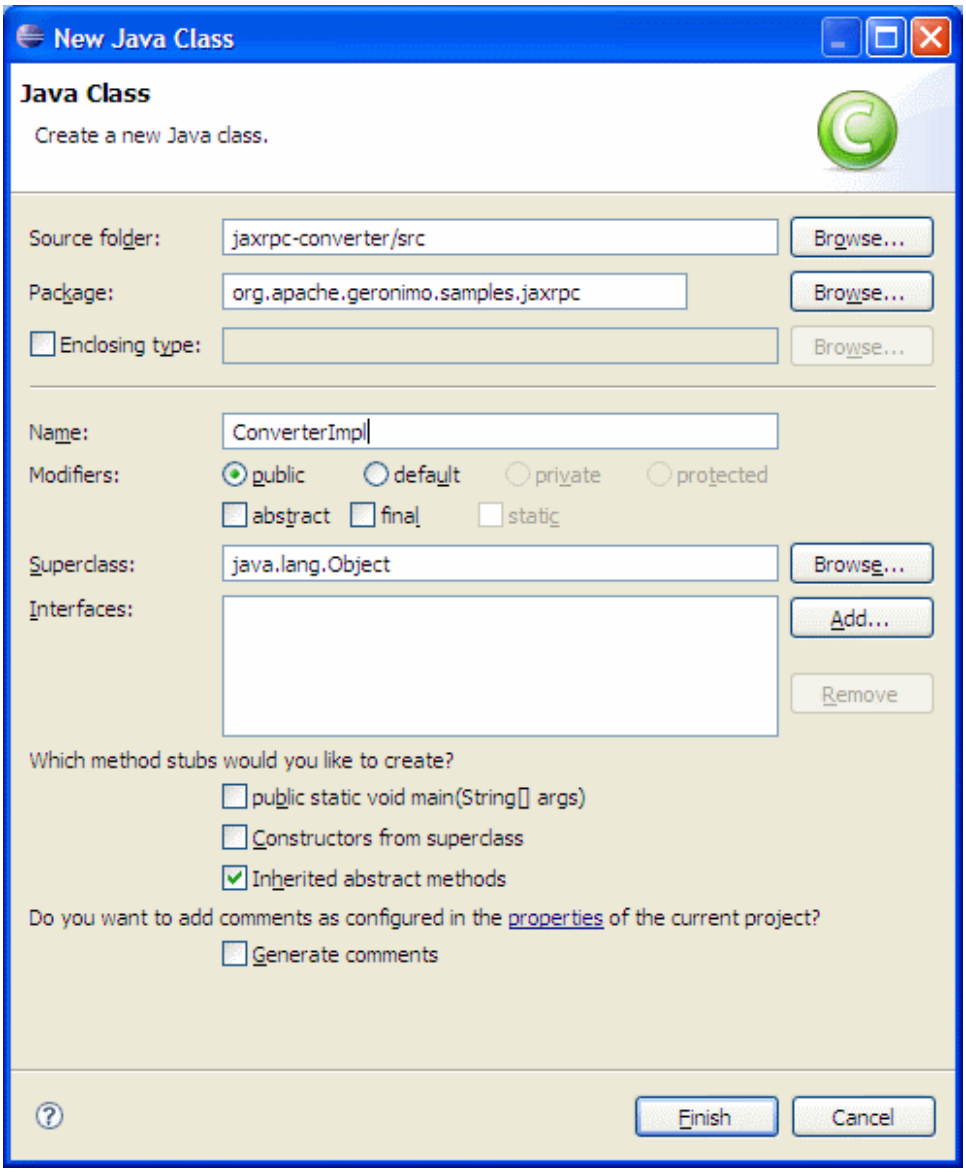
4. Name the interface as *Converter* and click **Finish**.



5. Add the following code to the **Converter** interface class: solidConverter.java package org.apache.geronimo.samples.jaxrpc; import java.math. BigDecimal; import java.rmi.Remote; import java.rmi.RemoteException; public interface Converter extends Remote{ public BigDecimal dollarToRupees(BigDecimal dollars) throws RemoteException; public BigDecimal rupeesToEuro(BigDecimal rupees) throws RemoteException; }
6. Right click on the new package and select **New -> Class**.



7. Name the class as *ConverterImpl* and click **Finish**.



8. Add the following code to the **ConverterImpl** class: solidConverterImpl.java package org.apache.geronimo.samples.jaxrpc; import java.math. BigDecimal; import java.rmi.RemoteException; public class ConverterImpl implements Converter{ private BigDecimal rupeeRate = new BigDecimal("40.58"); private BigDecimal euroRate = new BigDecimal("0.018368"); public BigDecimal dollarToRupees(BigDecimal dollars) throws RemoteException { BigDecimal result = dollars.multiply(rupeeRate); return result.setScale(2, BigDecimal.ROUND_UP); } public BigDecimal rupeesToEuro(BigDecimal rupees) throws RemoteException { BigDecimal result = rupees.multiply(euroRate); return result.setScale(2, BigDecimal.ROUND_UP); } }

This completes the development of Web services implementation code.

Service Endpoint Requirement
According to JAX-RPC specification, RPC Endpoint should extend Remote Class.

Setting up the deployment descriptor and deployment plan

WSDL file
For JAX-WS services, the WSDL file is automatically created by Geronimo at deploy time. However, there is no such facility for RPC services.

Setting up the deployment descriptor

Expand **WEB-INF** directory and add the following code to `web.xml`:

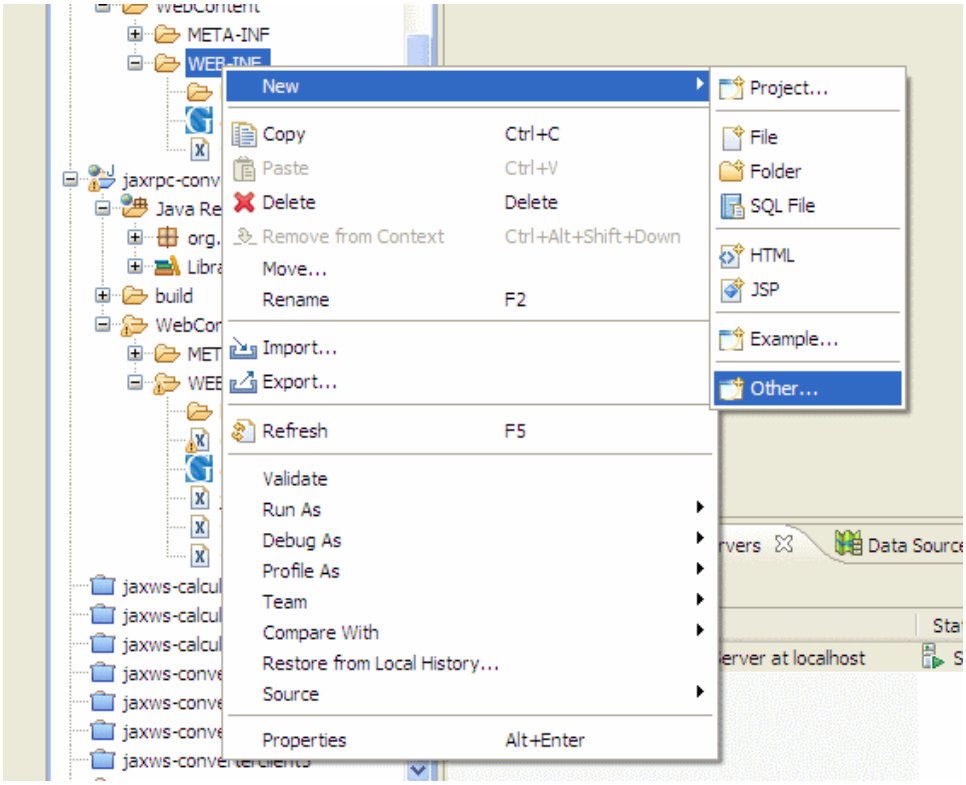
solidweb.xml <?xml version="1.0" encoding="UTF-8"?> <web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="http://java.sun.com /xml/ns/javaee" xmlns:web="http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd" xsi:schemaLocation="http://java.sun.com/xml/ns/javaee http://java.sun. com/xml/ns/javaee/web-app_2_5.xsd" id="WebApp_ID" version="2.5"> <display-name>jaxrpc-converter</display-name> <servlet> <display-name>JAX-RPC Converter Service</display-name> <servlet-name>JAXRPCConverterService</servlet-name> <servlet-class> org.apache.geronimo.samples.jaxrpc.

ConverterImpl </servlet-class> </servlet> <servlet-mapping> <servlet-name>JAXRPCConverterService</servlet-name> <url-pattern>/converter</url-pattern> </servlet-mapping> </web-app>

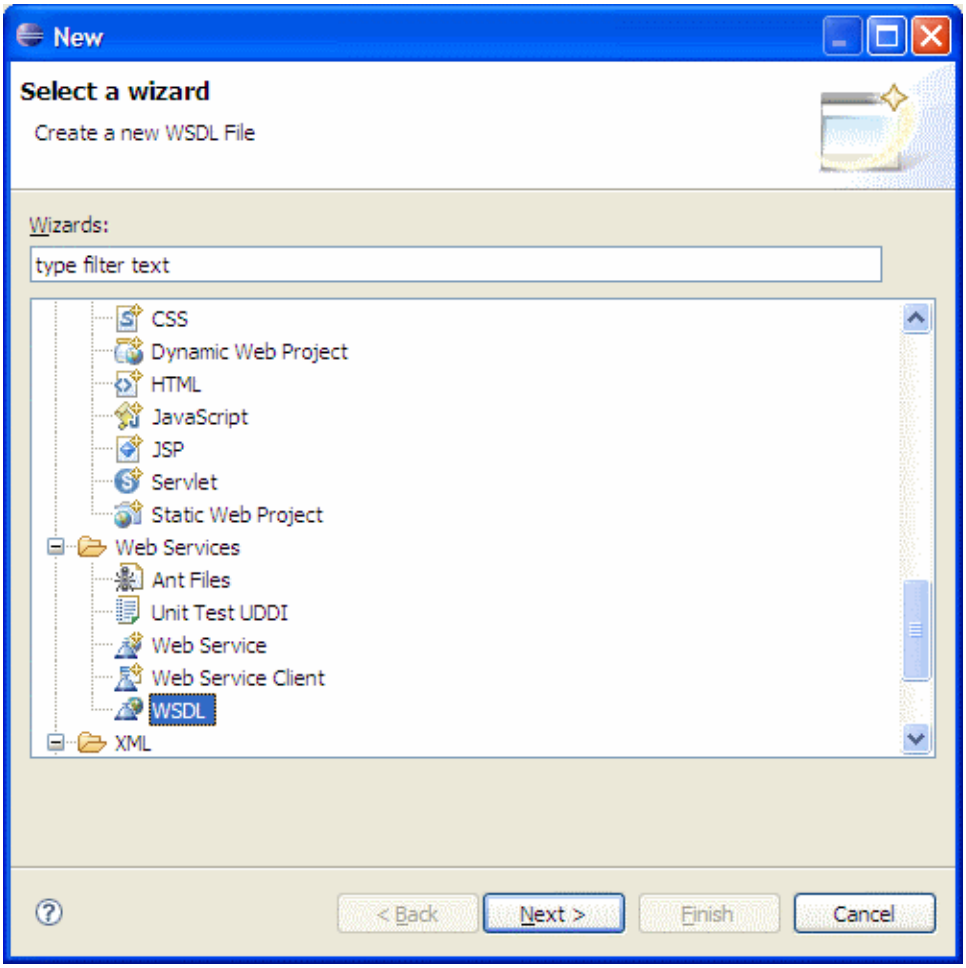
Now we need to create some additional files which will configure and describe the service.

Creating the WSDL file

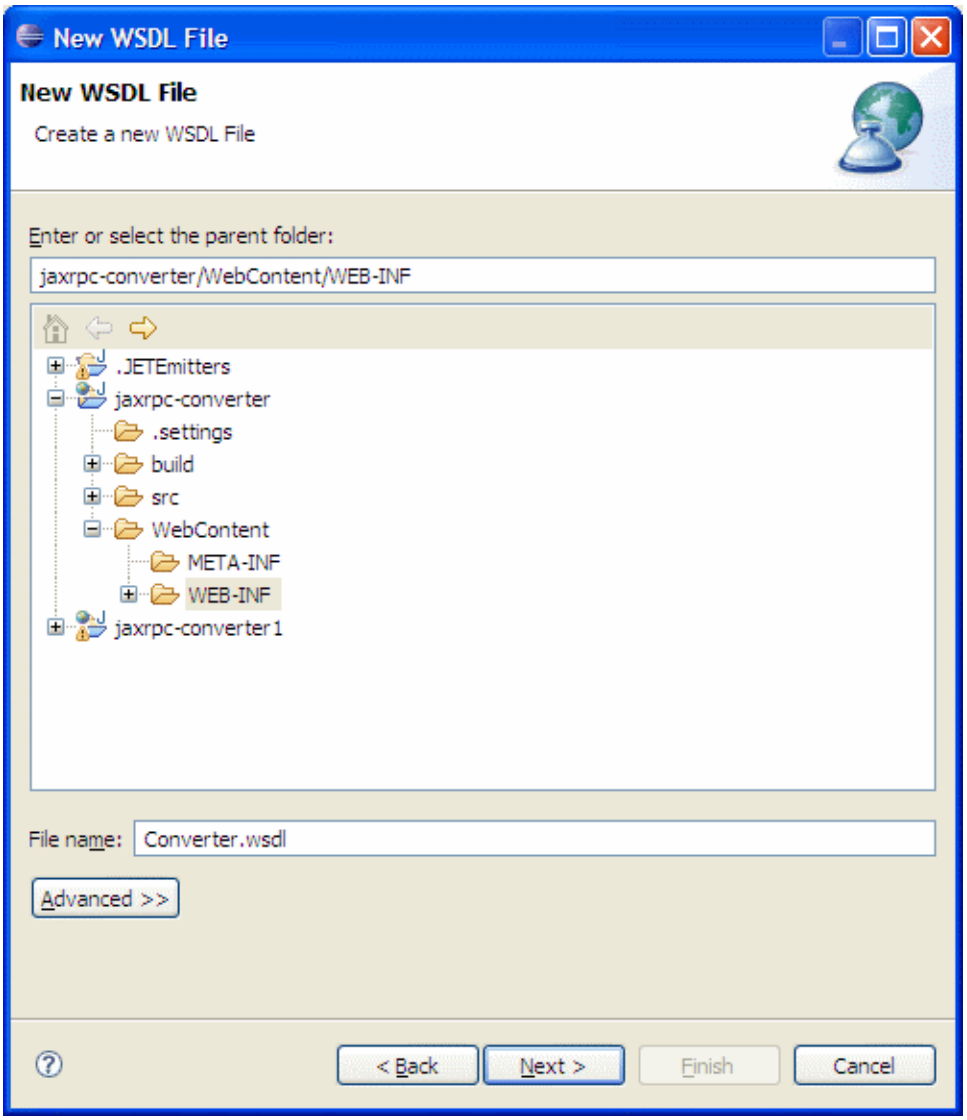
1. Right-click the **WEB-INF** directory and select **New -> Other**



2. Select **WSDL** from the *Web Services* category in the popup box.



3. Name the file as *Converter.wsdl* and click **Finish**.

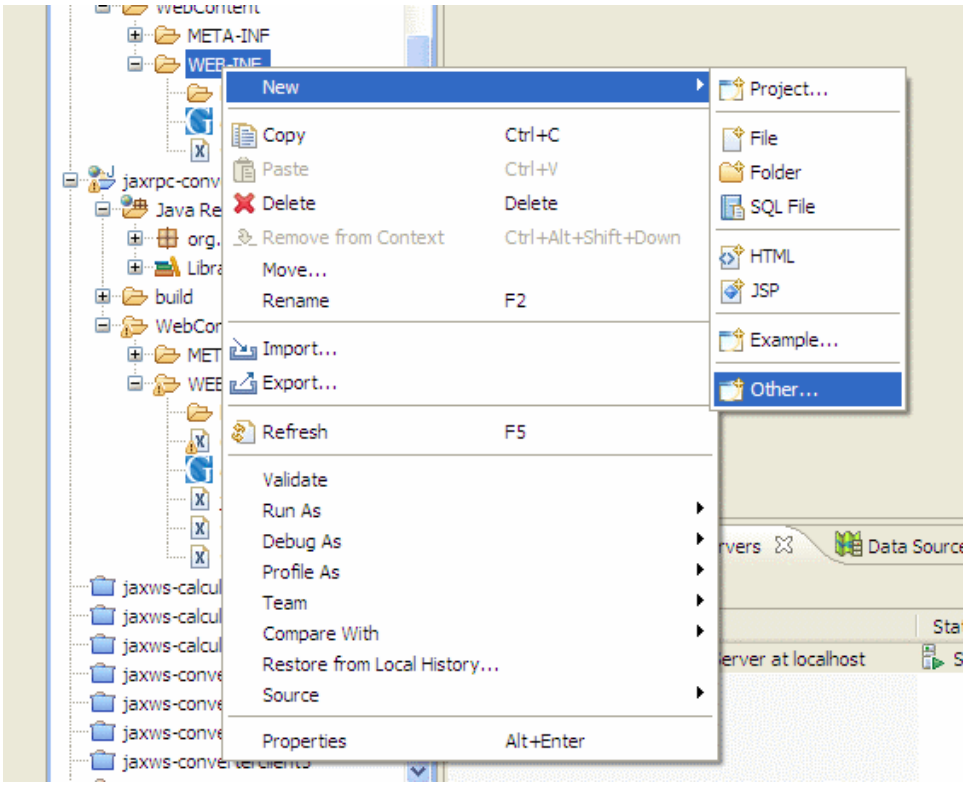


4. Add the following code to `Converter.wsdl`:

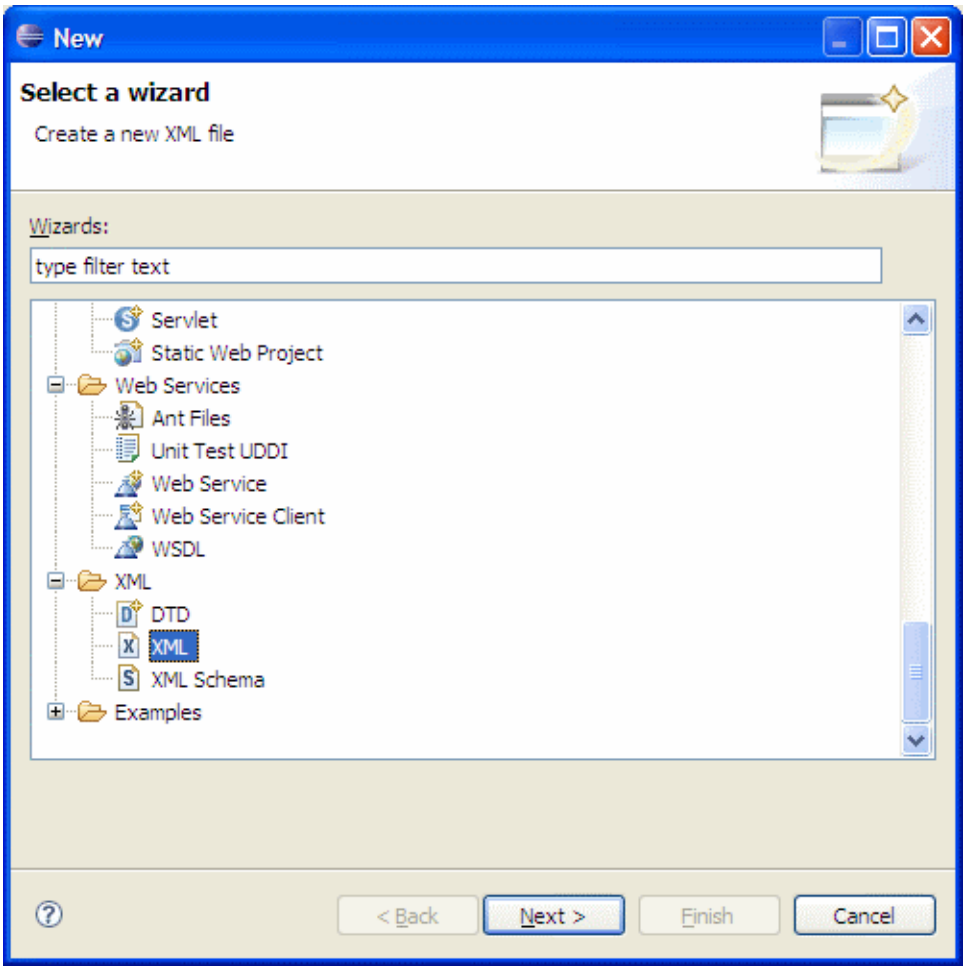
solidConverter.wsdl <?xml version="1.0" encoding="UTF-8"?> <wsdl:definitions xmlns="http://schemas.xmlsoap.org/wsdl/" xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:tns="http://org.apache.geronimo.samples.jaxrpc/" xmlns:x1="http://org.apache.geronimo.samples.jaxrpc/types" xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/" xmlns:xsd="http://www.w3.org/2001/XMLSchema" targetNamespace="http://org.apache.geronimo.samples.jaxrpc/" name="Converter"> <wsdl:message name="dollarToRupeesRequest"> <wsdl:part name="in" type="xsd:decimal" /> </wsdl:message> <wsdl:message name="dollarToRupeesResponse"> <wsdl:part name="out" type="xsd:decimal" /> </wsdl:message> <wsdl:message name="rupeesToEuroRequest"> <wsdl:part name="in" type="xsd:decimal" /> </wsdl:message> <wsdl:message name="rupeesToEuroResponse"> <wsdl:part name="out" type="xsd:decimal" /> </wsdl:message> <wsdl:portType name="Converter"> <wsdl:operation name="dollarToRupees"> <wsdl:input message="tns:dollarToRupeesRequest" name="dollarToRupeesRequest" /> <wsdl:output message="tns:dollarToRupeesResponse" name="dollarToRupeesResponse" /> </wsdl:operation> <wsdl:operation name="rupeesToEuro"> <wsdl:input message="tns:rupeesToEuroRequest" name="rupeesToEuroRequest" /> <wsdl:output message="tns:rupeesToEuroResponse" name="rupeesToEuroResponse" /> </wsdl:operation> </wsdl:portType> <wsdl:binding name="ConverterSOAPBinding" type="tns:Converter"> <soap:binding style="rpc" transport="http://schemas.xmlsoap.org/soap/http" /> <wsdl:operation name="dollarToRupees"> <soap:operation soapAction="" style="rpc" /> <wsdl:input name="dollarToRupeesRequest"> <soap:body use="literal" namespace="http://org.apache.geronimo.samples.jaxrpc/"/> </wsdl:input> <wsdl:output name="dollarToRupeesResponse"> <soap:body use="literal" namespace="http://org.apache.geronimo.samples.jaxrpc/"/> </wsdl:output> </wsdl:operation> <wsdl:operation name="rupeesToEuro"> <soap:operation soapAction="" style="rpc" /> <wsdl:input name="rupeesToEuroRequest"> <soap:body use="literal" namespace="http://org.apache.geronimo.samples.jaxrpc/"/> </wsdl:input> <wsdl:output name="rupeesToEuroResponse"> <soap:body use="literal" namespace="http://org.apache.geronimo.samples.jaxrpc/"/> </wsdl:output> </wsdl:operation> </wsdl:binding> <wsdl:service name="ConverterService"> <wsdl:port binding="tns:ConverterSOAPBinding" name="ConverterPort"> <soap:address location="http://localhost:8080/jaxrpc-converter/ConverterPort" /> </wsdl:port> </wsdl:service> </wsdl:definitions>

Creating jaxrpcmapping.xml

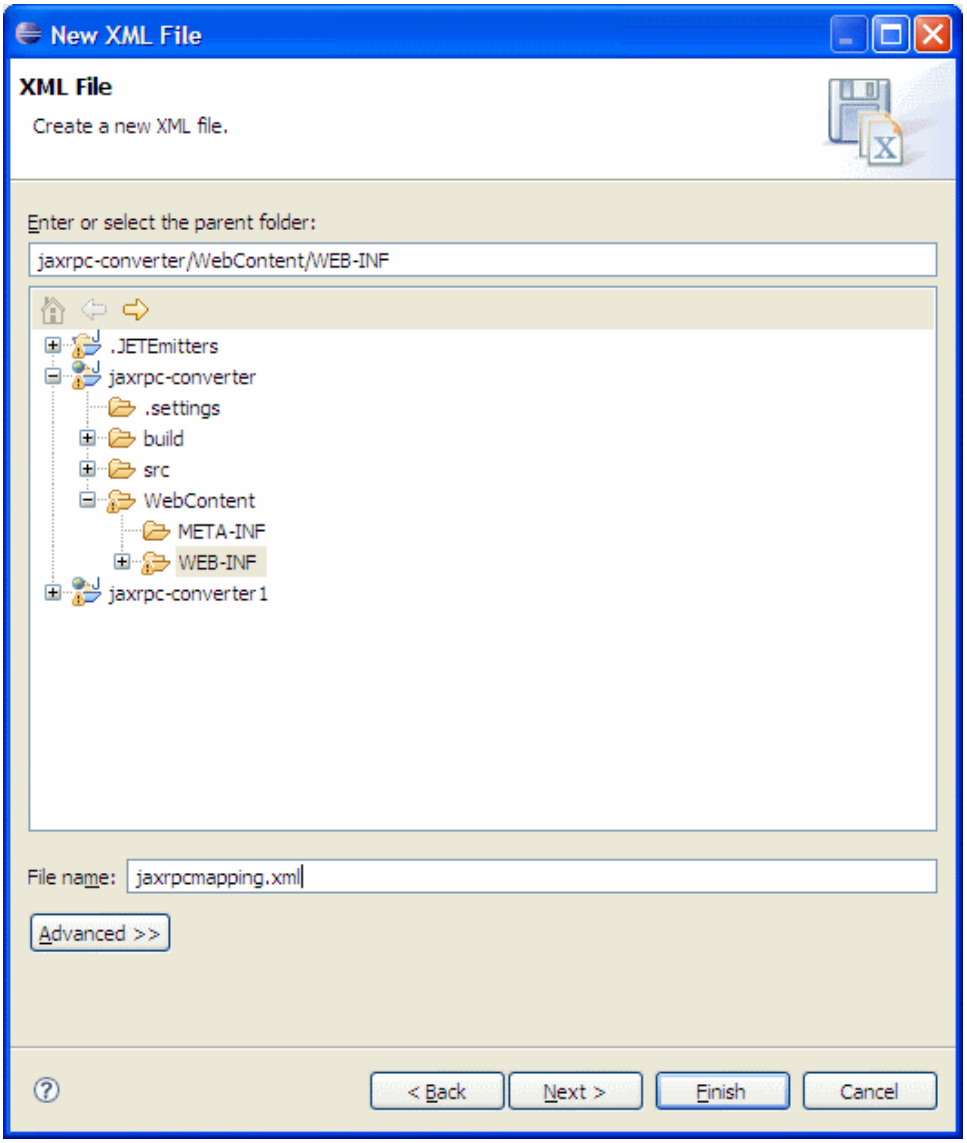
1. Right click the **WEB-INF** directory and select **New -> Other**



2. Select **XML** from the **XML** category in the popup box.



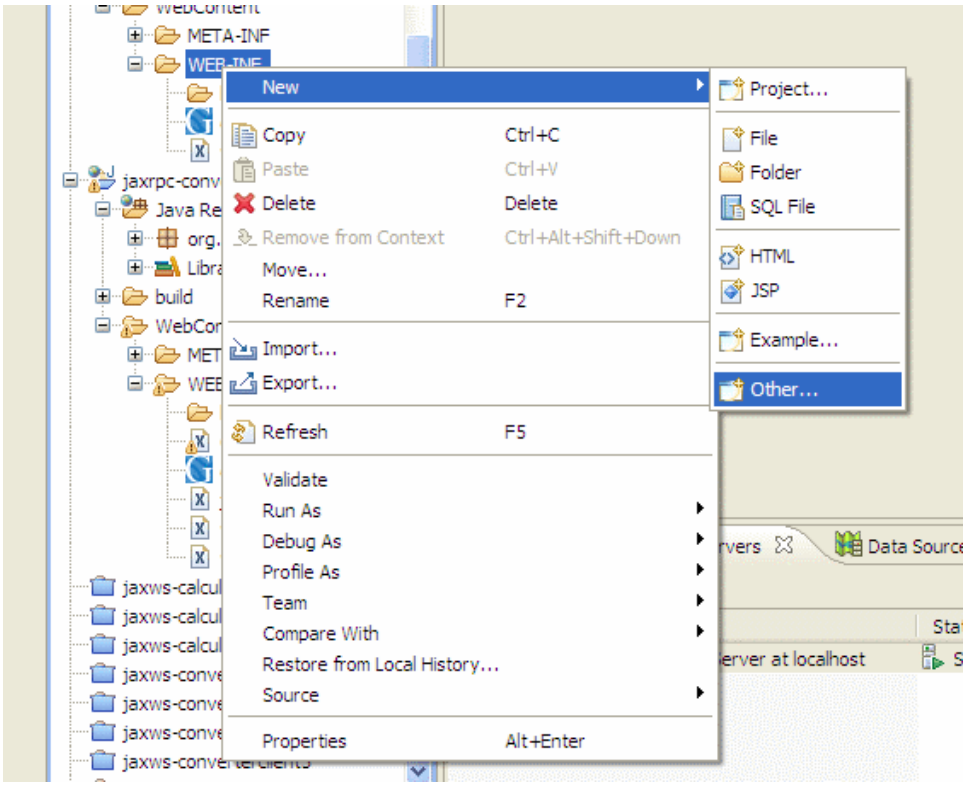
3. Name the file as *jaxrpcmapping.xml* and click **Finish**.



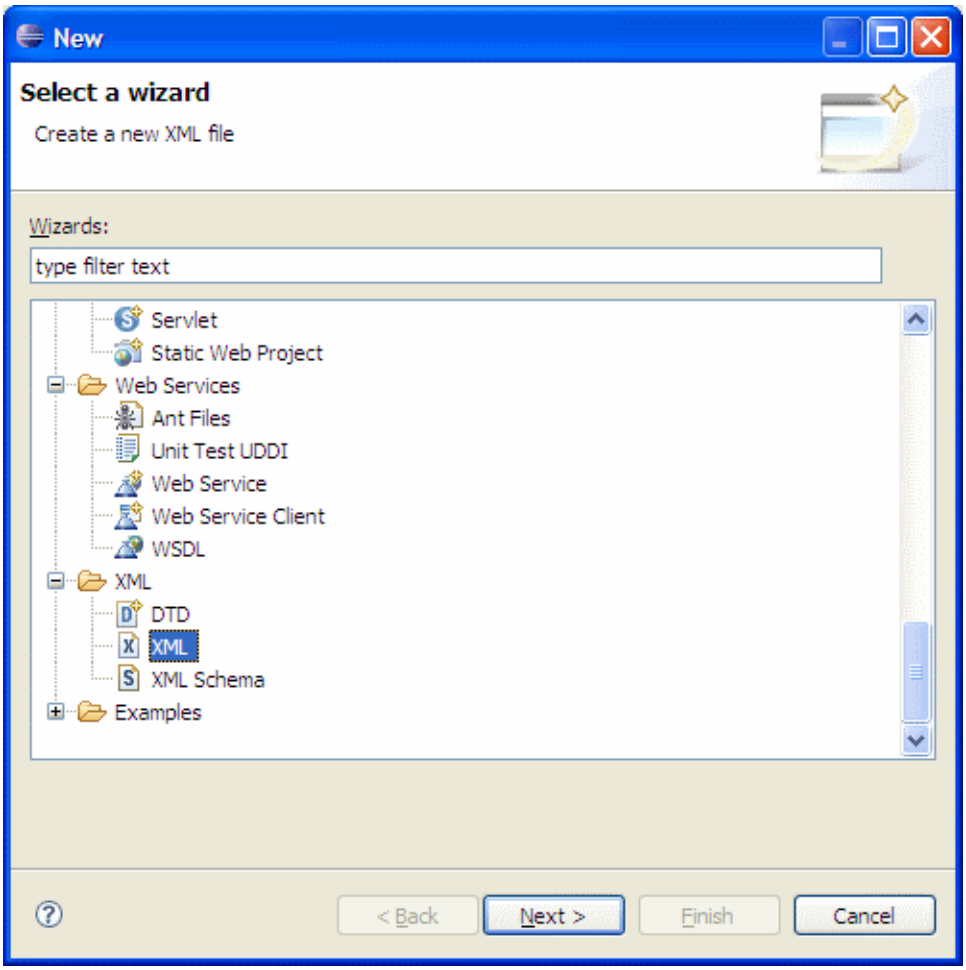
4. Add the following code to `jaxrpcmapping.xml`: solidjaxrpcmapping.xml <?xml version="1.0" encoding="UTF-8"?> <java-wsdl-mapping xmlns=" http://java.sun.com/xml/ns/j2ee" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="1.1"> </java-wsdl-mapping>

Creating webservices.xml

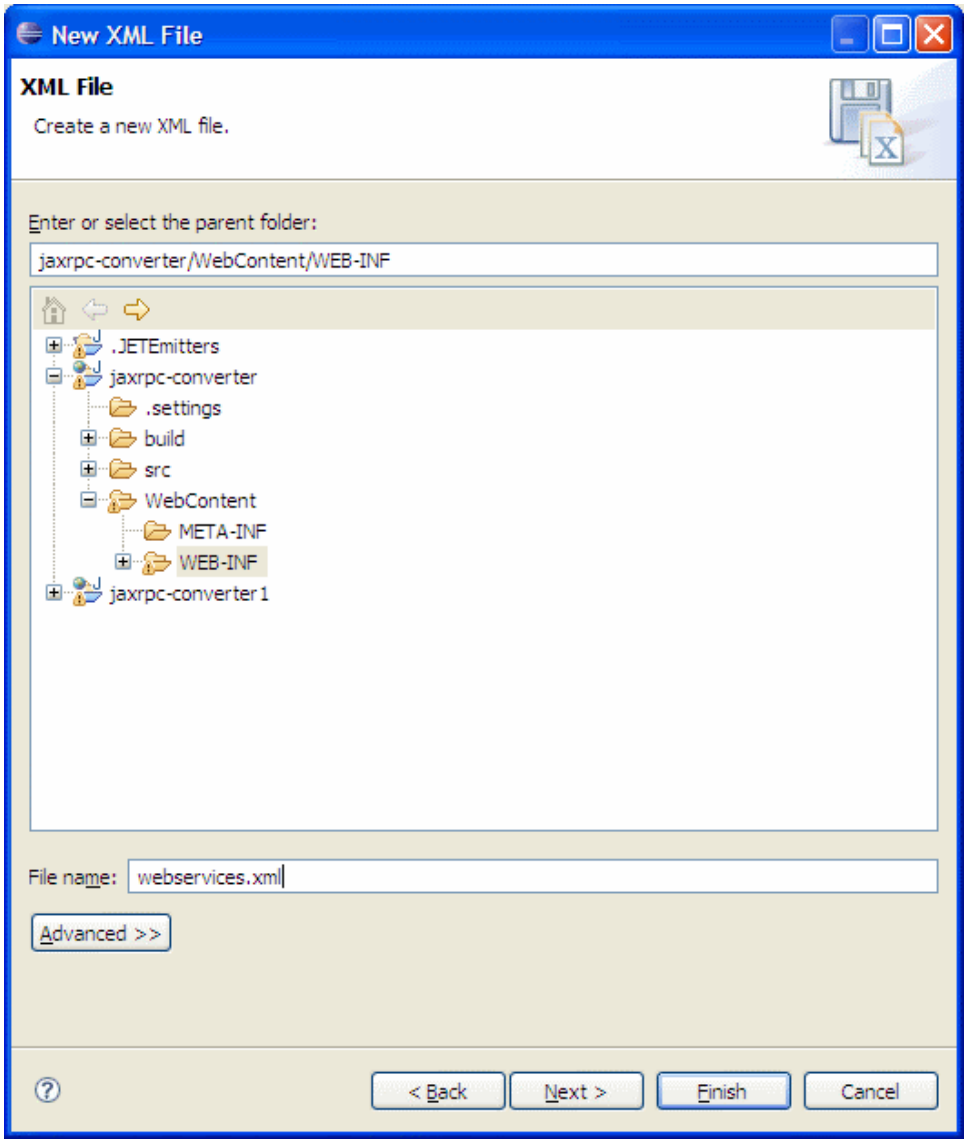
1. Right-click the **WEB-INF** directory and select **New -> Other**



2. Select **XML** from the **XML** category in the popup box.



3. Name the file as *webservices.xml* and click **Finish**.



4. Add the following code to `webservices.xml`: solidwebservices.xml <?xml version="1.0" encoding="UTF-8"?> <webservices xmlns="http://java.sun.com/xml/ns/j2ee" version="1.1"> <webservice-description> <webservice-description-name>JAX-RPC Converter Service</webservice-description-name> <wsdl-file>WEB-INF/Converter.wsdl</wsdl-file> <jaxrpc-mapping-file>WEB-INF/jaxrpcmapping.xml</jaxrpc-mapping-file> <port-component> <port-component-name>ConverterPort</port-component-name> <wsdl-port>ConverterPort</wsdl-port> <service-endpoint-interface>org.apache.geronimo.samples.jaxrpc.Converter</service-endpoint-interface> <service-impl-bean> <servlet-link>JAXRPCConverterService</servlet-link> </service-impl-bean> </port-component> </webservice-description> </webservices> This completes the setting up of Deployment Descriptor and Deployment Plans.

Let us walk through the files that we created.

- `Converter.wsdl` - Here we specify the web methods which are exposed and what are the request parameters and return parameters. We also specify other details like **targetNamespace**, **service name**, **binding**, **port name**, **port type**.
- `jaxrpcmapping.xml` - Actually this file specifies the mapping between the java methods and WSDL messages. Here it is not required as we are mapping all the methods to WSDL. For Further reference here is a sample that how a method will be mapped from Java to WSDL. solidjaxrpc mapping.xml <?xml version="1.0" encoding="UTF-8"?> <java-wsdl-mapping xmlns="http://java.sun.com/xml/ns/j2ee" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:Converter="http://org.apache.geronimo.samples.jaxrpc/" version="1.1"> <package-mapping> <package-type>org.apache.geronimo.samples.jaxrpc</package-type> <namespaceURI>urn:geronimo-samples</namespaceURI> </package-mapping> <service-interface-mapping> <service-interface> org.apache.geronimo.samples.jaxrpc.Converter; </service-interface> <wsdl-service-name> Converter:ConverterService </wsdl-service-name> <port-mapping> <port-name>ConverterPort</port-name> <java-port-name>ConverterPort</java-port-name> </port-mapping> </service-interface-mapping> <service-endpoint-interface-mapping> <service-endpoint-interface> org.apache.geronimo.samples.jaxrpc.Converter </service-endpoint-interface> <wsdl-port-type>Converter:Converter</wsdl-port-type> <wsdl-binding>Converter:ConverterSOAPBinding</wsdl-binding> <service-endpoint-method-mapping> <java-method-name>dollarToRupees</java-method-name> <wsdl-operation>dollarToRupees</wsdl-operation> <method-param-parts-mapping> <param-position>0</param-position> <param-type>java.math.BigDecimal</param-type> <wsdl-message-mapping> <wsdl-message> Converter:dollarToRupeesRequest </wsdl-

message> <wsdl-message-part-name>in</wsdl-message-part-name> <parameter-mode>IN</parameter-mode> </wsdl-message-mapping> < /method-param-parts-mapping> <wsdl-return-value-mapping> <method-return-value> java.math.BigDecimal </method-return-value> <wsdl-message> Converter:dollarToRupeesResponse </wsdl-message> <wsdl-message-part-name>out</wsdl-message-part-name> </wsdl-return-value-mapping> </service-endpoint-method-mapping> </service-endpoint-interface-mapping> </java-wsdl-mapping>

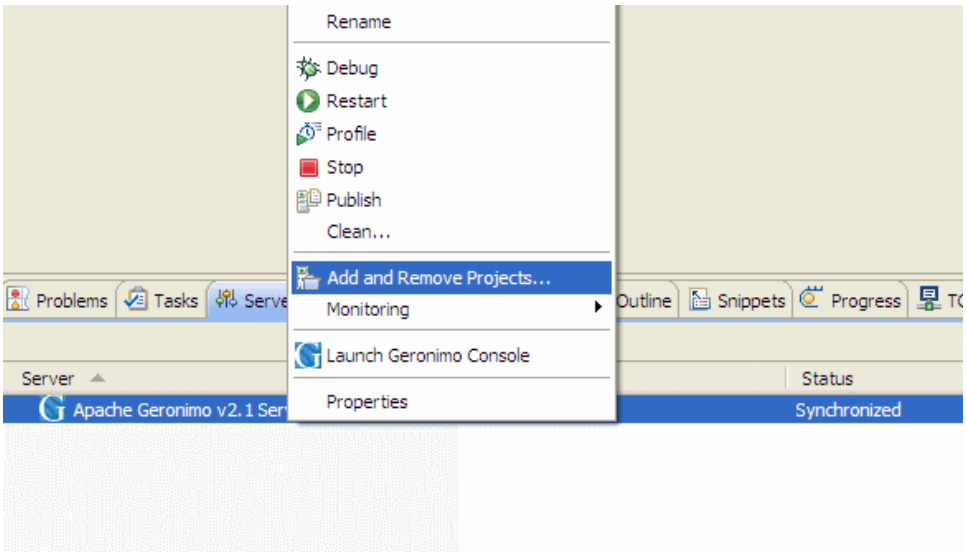
- `webservices.xml` - This is the file necessary for deploying any web services (JAX-RPC or JAX-WS). But starting from Java EE 5 webservices. xml is no longer necessary. This file contains all the necessary components to describe web service and where to find them.

Deploy and test the Web service

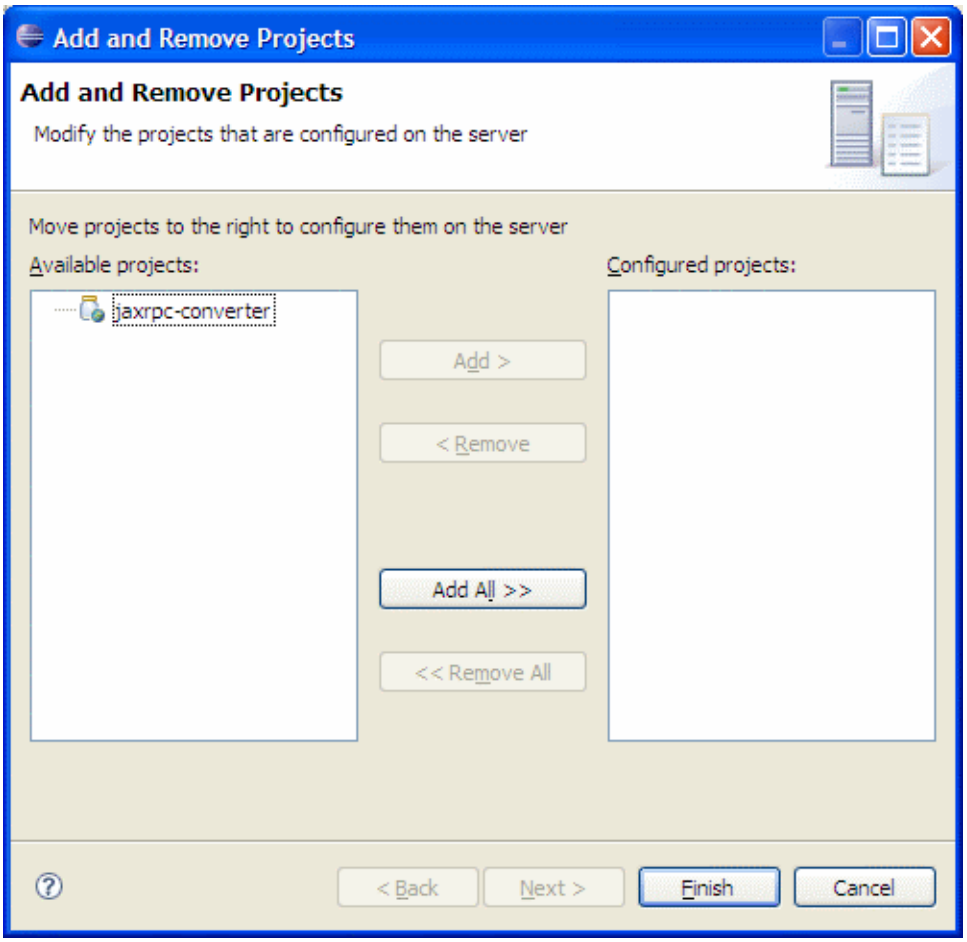
Now, we will look into the steps involved in deploying and testing our web service without any clients.

Deploy

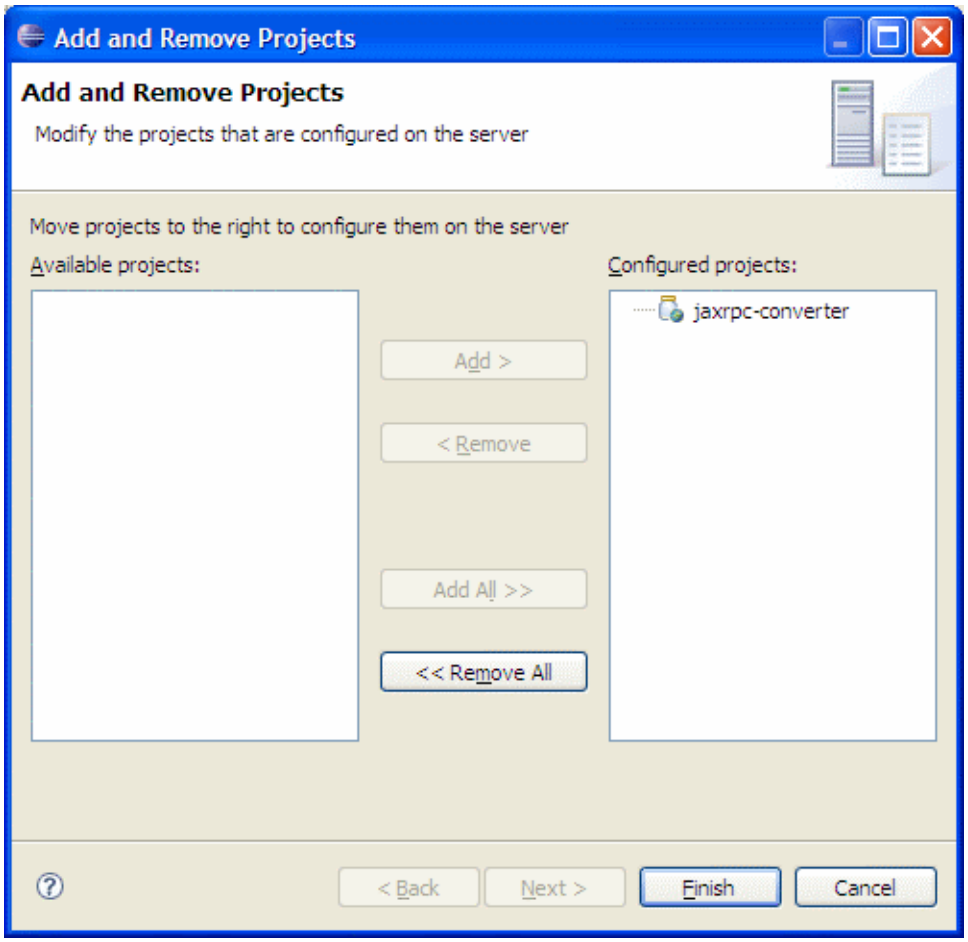
1. Right click on the **Apache Geronimo** Server Runtime present in the servers view and select **Add or Remove Projects**



2. In the popup dialog, select the **jaxrpc-converter** project and click **Add**



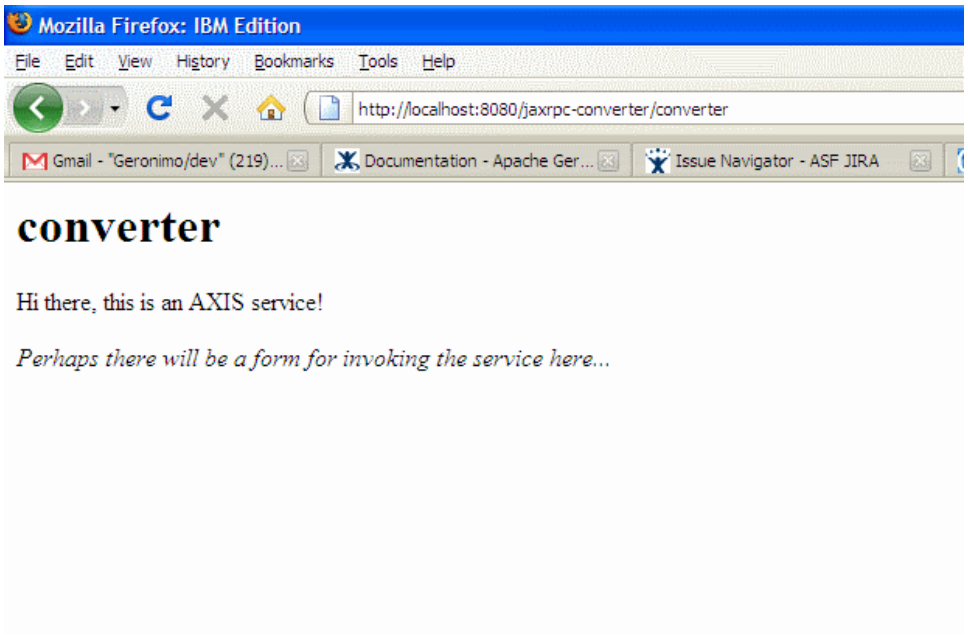
3. Make sure that **jaxrpc-converter** is in the **configured projects** list and then click **Finish**



4. Wait for some time till the server status is changed to synchronized.

Testing

1. Once the application is deployed on to the server, Launch a browser and go to the following url: http://localhost:8080/jaxrpc-converter/converter .
2. Now you should see the screen telling that this is Converter Web service.



WSDL File

You can also view the WSDL file generated by Geronimo based on the annotations specified by going to the following url: http://localhost:8080/jaxrpc-converter/converter?wsdl

Using Web Service Explorer in Eclipse
You can also use Web Services Explorer present in Eclipse to rapidly test your web service without developing a client.
To know how to use Web Services Explorer in Eclipse, one can refer to the Developing a JAX-WS POJO Web Service#Using Web Services Explorer in Eclipse

Changes required in Client

The most important change that you need to do in your client is to use `javax.xml.rpc.Service` instead of `javax.xml.ws.Service`.

Client Development
Client development is excluded from this tutorial because there is no big difference in creating a client for JAX-RPC Web Service and a JAX-WS Web Service.

You can refer to Developing a JAX-WS POJO Web Service tutorial for further knowledge about how to develop a client for Web Services.

The change you are required to do in the client JSP's are:

solidConverterClient.jsp URL url = new URL("http://localhost:8080/jaxrpc-converter/converter?wsdl"); QName qname = new QName("http://org.apache.geronimo.samples.jaxrpc/","ConverterService"); ServiceFactory factory = null; Service service = null; try { factory = ServiceFactory.newInstance(); service = factory.createService(url, qname); } catch (ServiceException e) { e.printStackTrace(); } Converter conv = (Converter) service.getPort(Converter.class);

EJB JAX-RPC Web Service

EJB JAX-RPC are very much similiar to POJO JAX-RPC we just implemented. Also the most important change between JAX-RPC and JAX-WS EJB Web service are the EJB anotations are not supported.

- The class files that are necessary for a EJB JAX-RPC Web Service are:
  - Service Endpoint Interface - Converter.java
  - Home Interface - ConverterHome.java
  - Remote Interface - ConverterRemote.java
  - Bean Implementation - ConverterBean.java EJB Classes
    These classes that are required by JAX-RPC are according to J2EE 1.4 standards (As JAX-RPC theoretically maps to J2EE 1.4).
- Also in `ejb-jar.xml`, one has to specify which class are you using as **Home**, **Remote**, **SEI**, **Bean**. A sample ejb-jar.xml may look like this: solide jb-jar.jsp <ejb-jar xmlns="http://java.sun.com/xml/ns/j2ee" version="2.1"> <enterprise-beans> <session> <ejb-name>Converter</ejb-name> <home>org.apache.geronimo.samples.jaxrpc.ConverterHome</home> <remote>org.apache.geronimo.samples.jaxrpc.ConverterRemote</remote> <service-endpoint>org.apache.geronimo.samples.jaxrpc.Converter</service-endpoint> <ejb-class>org.apache.geronimo.samples.jaxrpc.ConverterBean</ejb-class> <session-type>Stateless</session-type> <transaction-type>Container</transaction-type> </session> </enterprise-beans> </ejb-jar> This completes the development of JAX-RPC Web Services. After completing this tutorial you should have a understanding about how JAX-RPC Web Services are deployed.