**Developer User Study: Steps for CMU Experiments**

1. **Prerequisites:**
2. Install Apache Tomcat, Apache Axis2, and OWL-S Composer using install-prereqs.sh.
3. **Project Creation:**
4. Create a new Dynamic Web Project in Eclipse named ‘CMUExperiments’.
5. Set Target runtime environment to Apache Tomcat v9.0
   1. Create a ‘New Runtime’ with Name: Apache Tomcat v9.0
   2. Select Tomcat installation directory to the one installed by the install-tomcat.sh.
6. Modify the Configuration
   1. In Project Facets, select Axis2 Web Services.
   2. Modify the Dynamic Web Module to version 2.5.
   3. Modify Java from 10 to 1.8.
7. Navigate until Finish. It might complain that the Axis2 Runtime is not set.
   1. Go to Eclipse, Preferences, Web Services, Axis2 Preferences, Set the runtime location to the Axis2 directory installed by install-axis2.sh.
8. Right click on the project ‘CMUExperiments’, select Properties, ensure the following:
   1. Targeted Runtimes: is set to the Apache Tomcat v9.0
   2. Project Facets: Axis 2 Web Services is checked.
9. Copy dependencies from files/deps dir to WebContent/WEB-INF/lib and refresh project.
10. **Service Creation:**
11. Copy the src from files/src dir to the CMUExperiments directory.
12. **Service Description:**
13. Create a WSDL file for a service: say, YahooNewsService.
    1. Go to File, New, Other, Web Services, Web Service, Web service type: Bottom up Java bean Web Service, select the service implementation class.
    2. Under Configuration,
       1. Modify web service runtime to: Apache Axis2.
       2. Ensure Server runtime is: Tomcat v9.0 Server.
    3. Click next, generate a default services.xml file, click next, Start the server
14. The web service description is generated at WebContent/WEB-INF/services dir.
15. **Service Deployment:**
16. Start Axis2 using ‘start-axis2.sh’ script.
17. Copy the service description from WebContent/WEB-INF/services/YahooNewsService dir to Axis2’s service repository. That is: axis2-1.7.8/repository/services dir.
18. Open: <http://localhost:8080/axis2/services/> to see the service deployed. Click on the service link: say, YahooNewsService, to open the service WSDL.
19. Save the wsdl in the outputs/wsdl dir. For example, say YahooNewsService.wsdl. When you save, ensure that the Format is selected as “All Files”.
20. **Semantic Markup:**
21. Start the OWL-S Composer using the ‘start-owls-composer.sh’ script.
22. Enter the WSDL URL, for example, in either of the following ways, and press tab:
    1. <http://localhost:8080/axis2/services/YahooNewsService?wsdl>, or,
    2. Browse local: WSDL from outputs/wsdl/YahooNewsService.wsdl
23. Click on the operation for which we’d like to generate an OWL-S file, for example, getNewsFeed. It then populates the Service description on the right pane.
24. In Namespaces section, select OWL and click add, then enter, a namespace URL, say: <http://services.composition.inmind.cmu.edu>, and click ok. You’d notice that on the script console, the service namespace is printed.
25. Click on Generate OWL-S button, and save the generated OWL-S at the user’s home dir. It generates the OWL-S, prints it to console, and writes it to the file system.
26. Copy the OWL-S file to the outputs/owls dir, as follows:
    1. Create a dir with the service name (because two or more grounded services for a service API will generate OWL-S files with the same name.
    2. Save the OWL-S. Example: outputs/owls/YahooNewsService/getNewsFeed.owl
27. If the service has more than one method/operation, then repeat the steps 3-6 above to generate an OWL-S file for each method.

**Outputs:**

1. Place the “.wsdl” files in the outputs/wsdl dir as mentioned in E4.
2. Place the “.owl” files in the outputs/owls dir, by service, as mentioned in F6.

**Frequently Asked Questions:**

1. What if I do not have Java 1.8? You could either [download it](https://www.oracle.com/technetwork/java/javase/downloads/jre8-downloads-2133155.html) or use 1.6+ versions.
2. When you start the server while generating the service description, it says that that several ports are already in use. This happens because you may have a Tomcat instance running with the same ports, so, modify the ports for this instance of the server.
3. How do I modify the Tomcat server ports in Eclipse? Go to Servers, Tomcat v9.0, server.xml, do the following:
   1. Locate the Connector tag, modify the port from 8080 to something else, say 9090, and redirectPort from 8443 to 9443.
   2. Locate the Connector tag for AJP 1.3 Connector, modify the port from 8009 to something else, say 9009, and redirectPort from 8443 to 9443.
4. How do I modify the Tomcat server ports in the Tomcat installed by the script? In the Tomcat directory, open conf/server.xml, then, do the same as above in 3.
5. I see an exception on the OWL-S Composer terminal. You may ignore it as long as you see the operations of the service listed on the left pane.