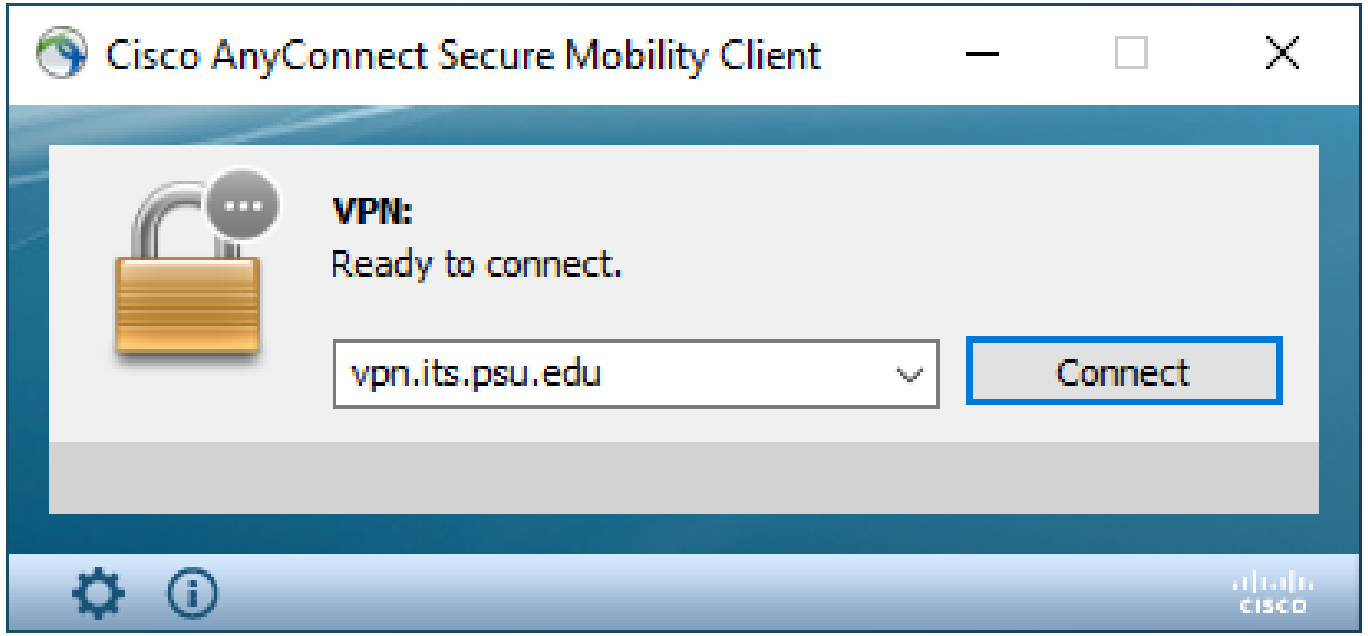
JAVA CLIENT-SERVER APP WITH XML (SOAP) WEB SERVICES

This exercise was adapted from the following tutorials, which I encourage you to review for more information:

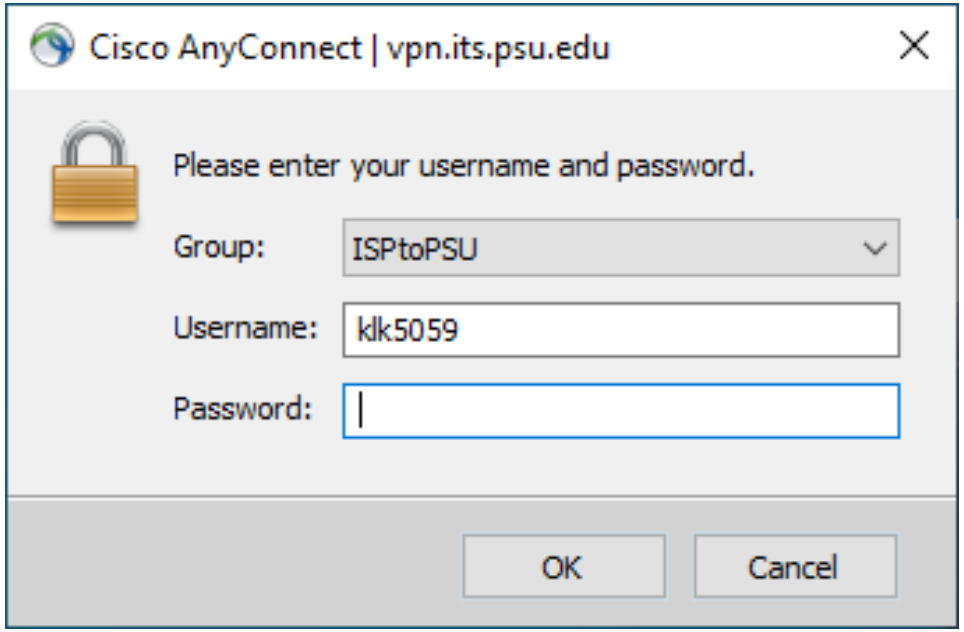
- CodeJava: Java Client Server XML Web Services (JAX-WS) Tutorial by Nam Ha Minh
- LinkedIn Learning: Java EE 7: Web Services (by Kesha Williams) *Available through the IST411/MIS466 LinkedIn Learning Collection

PART 1: CONNECT TO VPN AND SIGN INTO VIRTUAL MACHINE

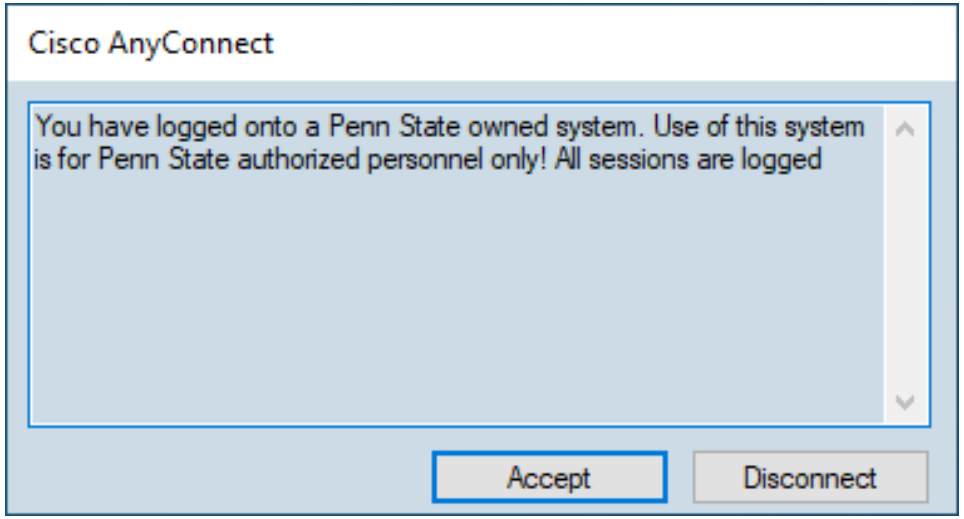
STEP 1: Open the Cisco AnyConnect Secure Mobility Client application. Select ***vpn.its.psu.edu*** and click the ***Connect*** button.



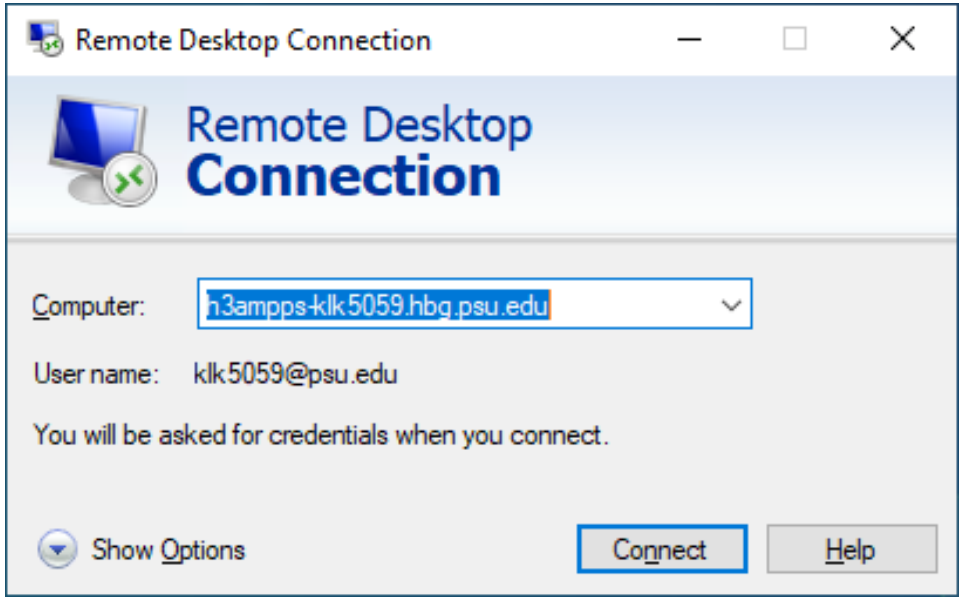
STEP 2: In the ***Cisco AnyConnect | vpn.its.psu.edu*** dialog, enter your Penn State username and password and click the ***OK*** button.



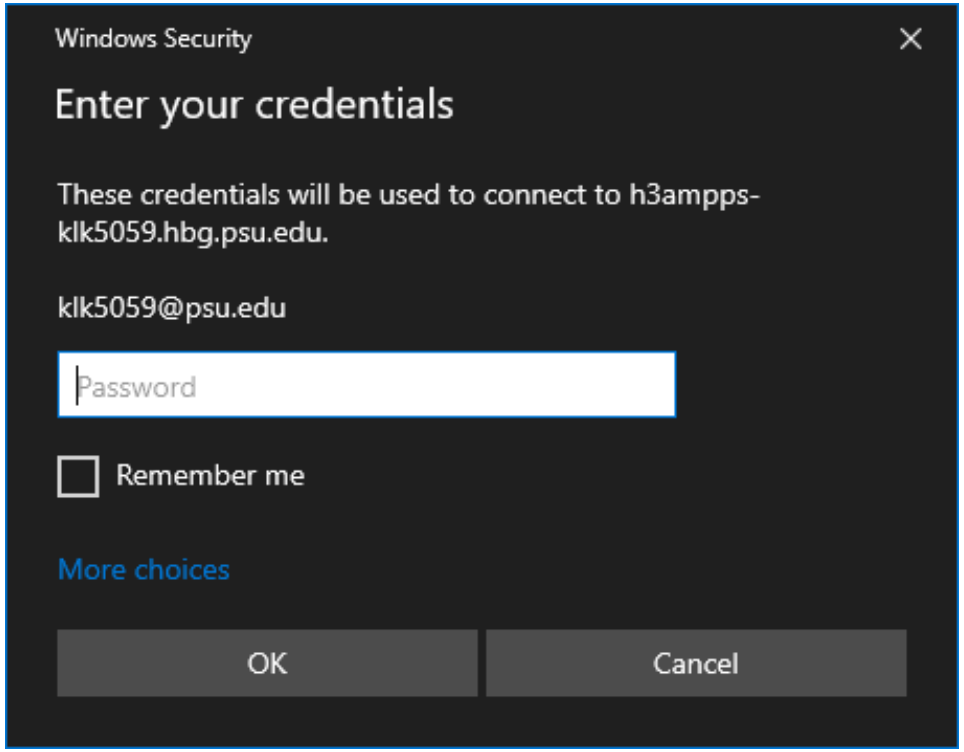
STEP 3: In the ***Cisco AnyConnect*** dialog, click the ***Accept*** button.



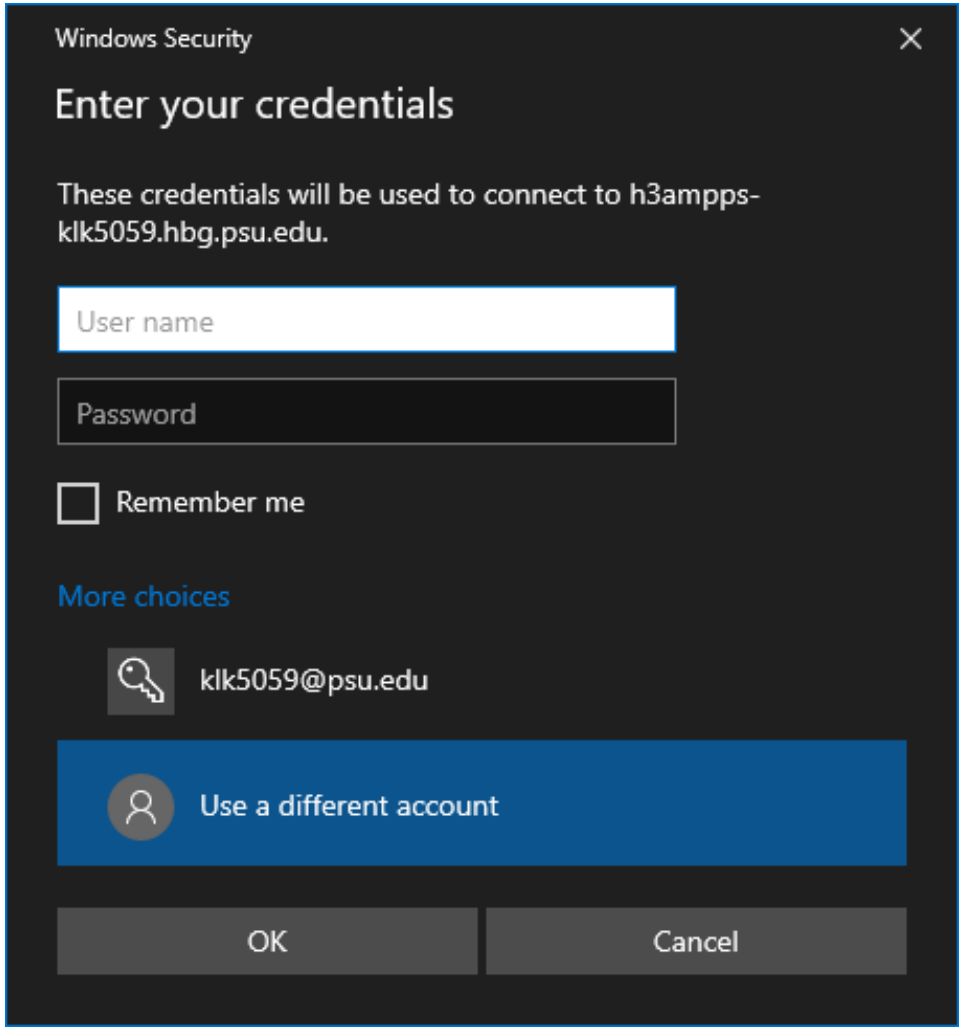
STEP 4: Open the Remote Desktop Connection application and enter ***h3ampps-yourpsuusername.hbg.psu.edu*** (where ***yourpsuusername*** is your Penn State username, for example: h3ampps-klk5059.hbg.psu.edu). Click the ***Connect*** button.



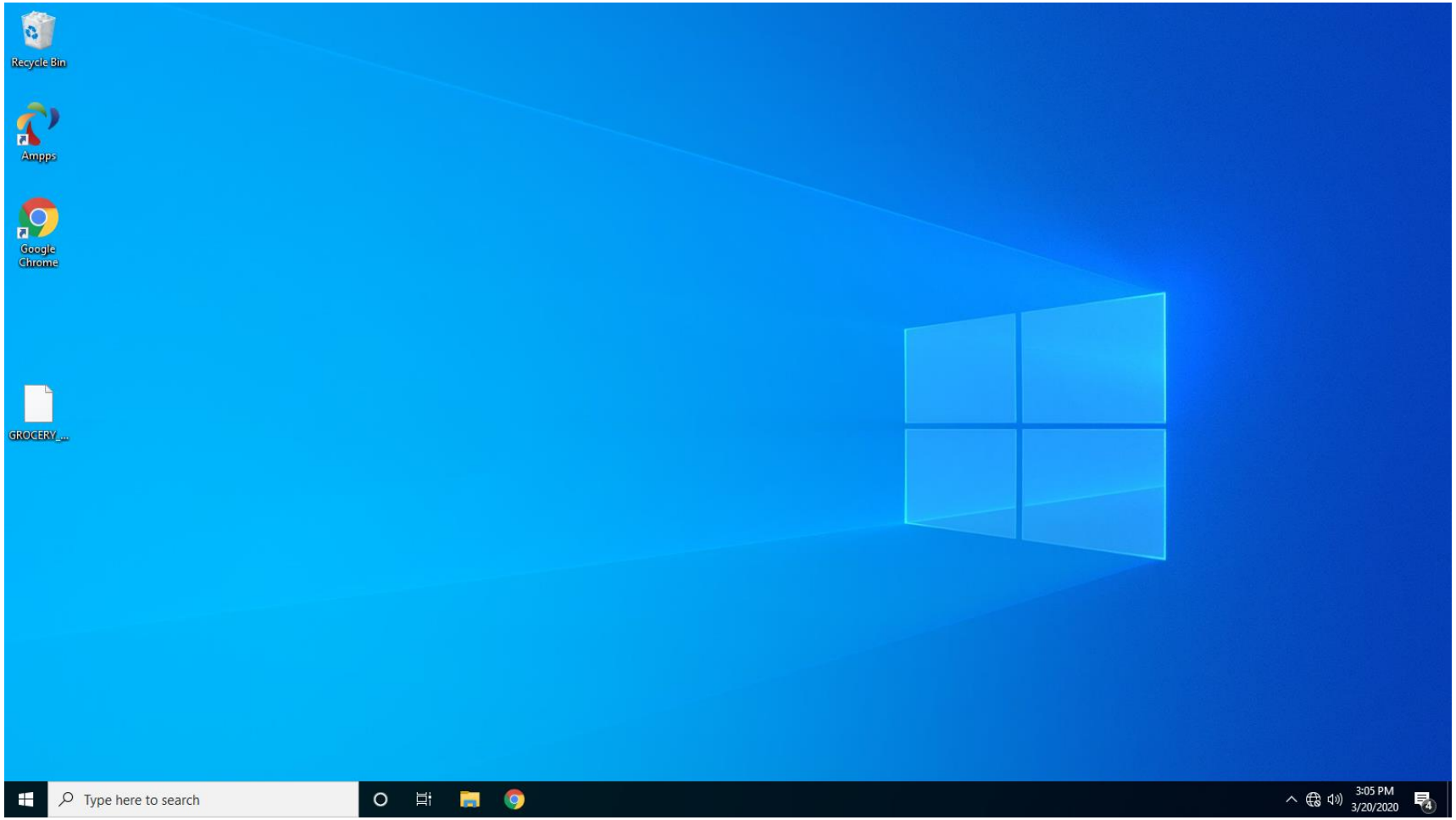
STEP 5: In the ***Windows Security*** dialog, select ***More choices***.



STEP 6: Select ***Use a different account***. Enter your Penn State ***email address*** and password. Click the ***OK*** button.

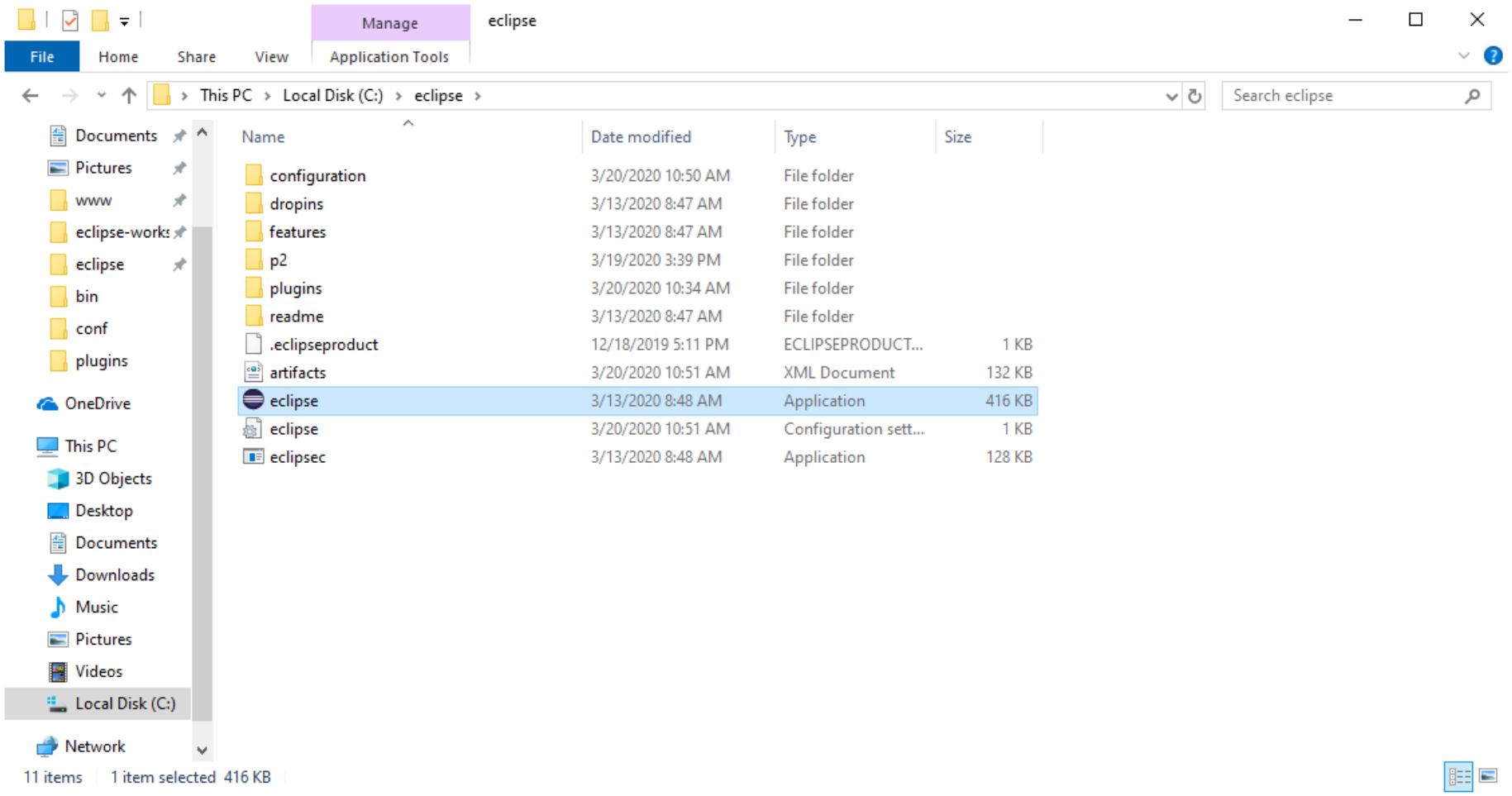


STEP 7: You should now see the desktop of your virtual machine.

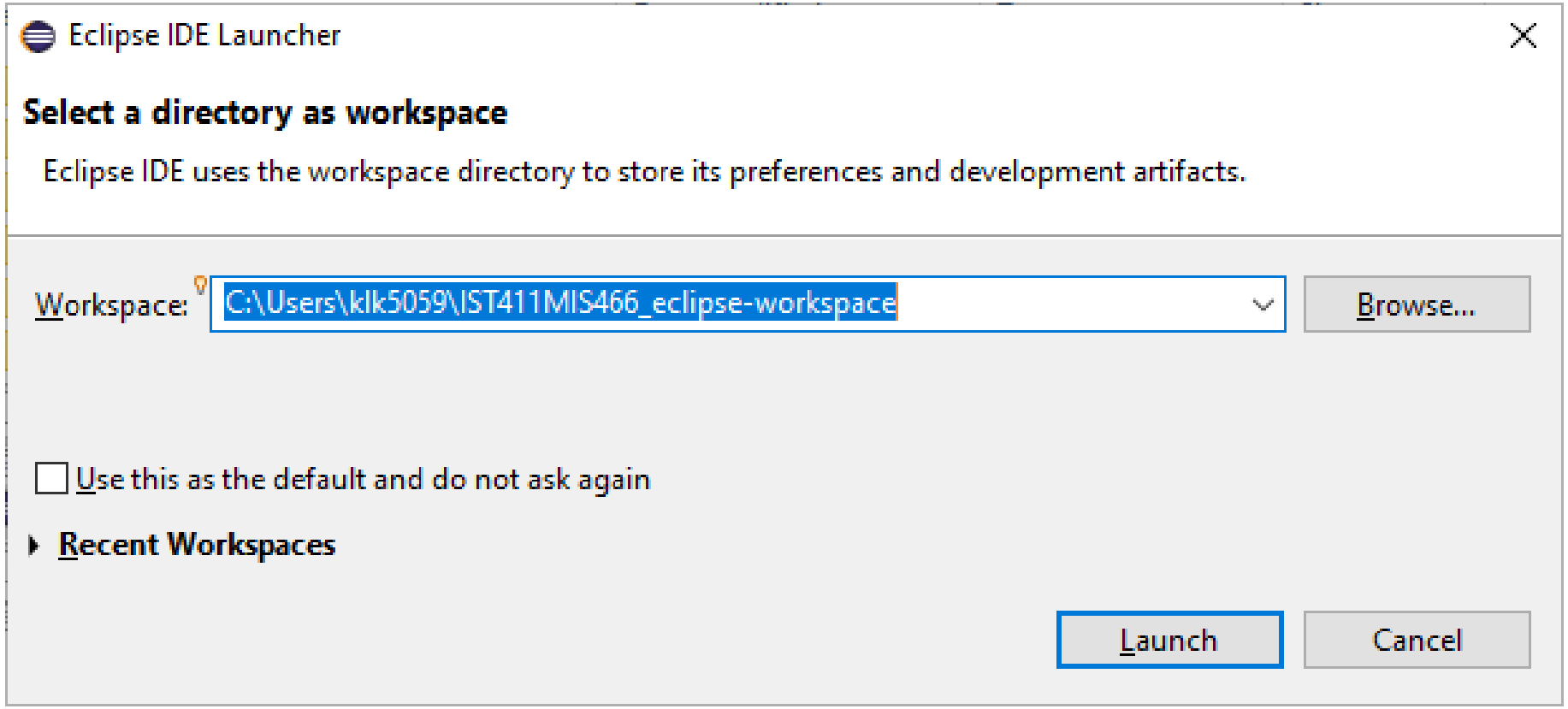


PART 2: OPEN ECLIPSE

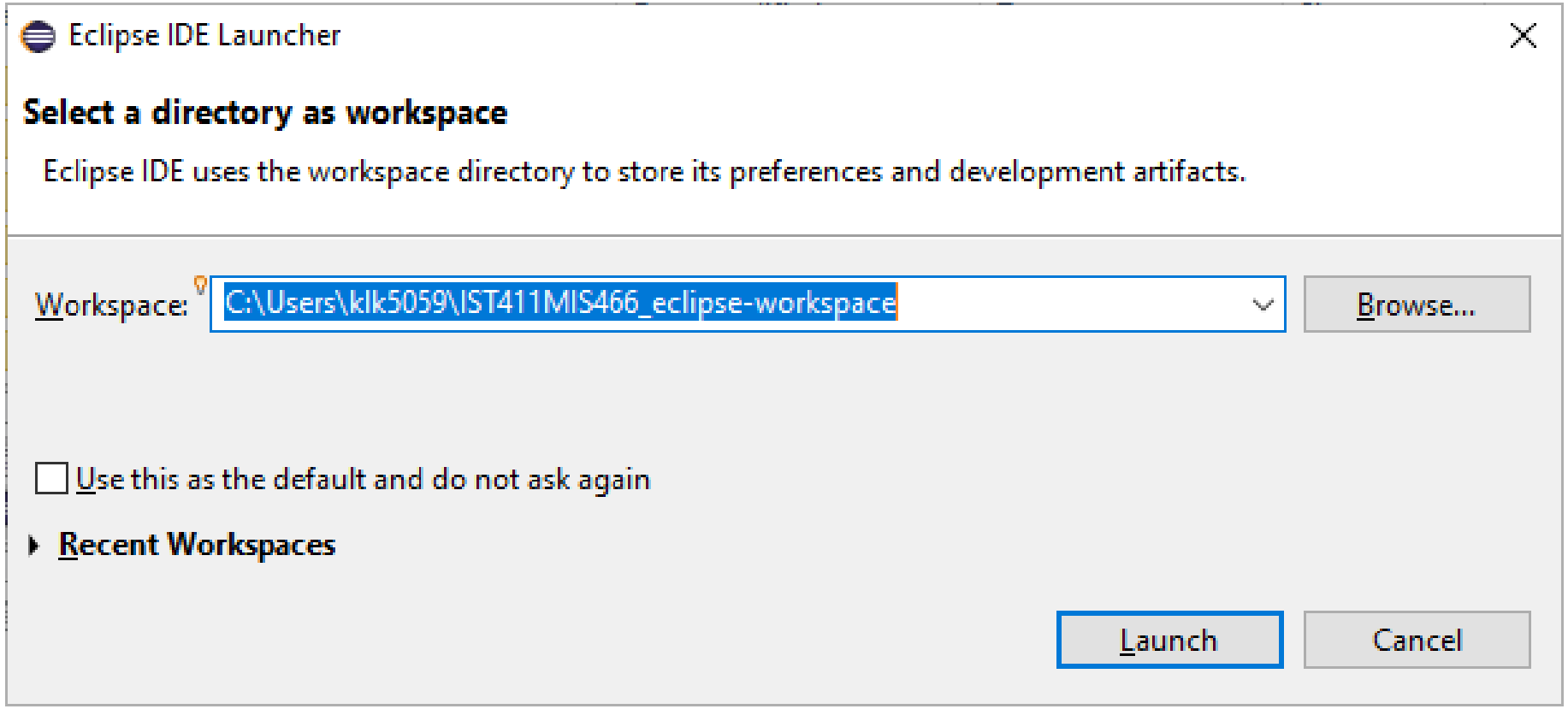
STEP 1: In a File Explorer window, navigate to ***C:\eclipse*** and launch the Eclipse application (highlighted in the screenshot below).



STEP 2: In the ***Eclipse IDE Launcher*** dialog, select (or enter) a directory that you want to use as your workspace. I created a folder called ***IST411MIS466_eclipse-workspace***, in the directory ***C:\Users\klk5059*** to use for my workspace. Click the ***Launch*** button.

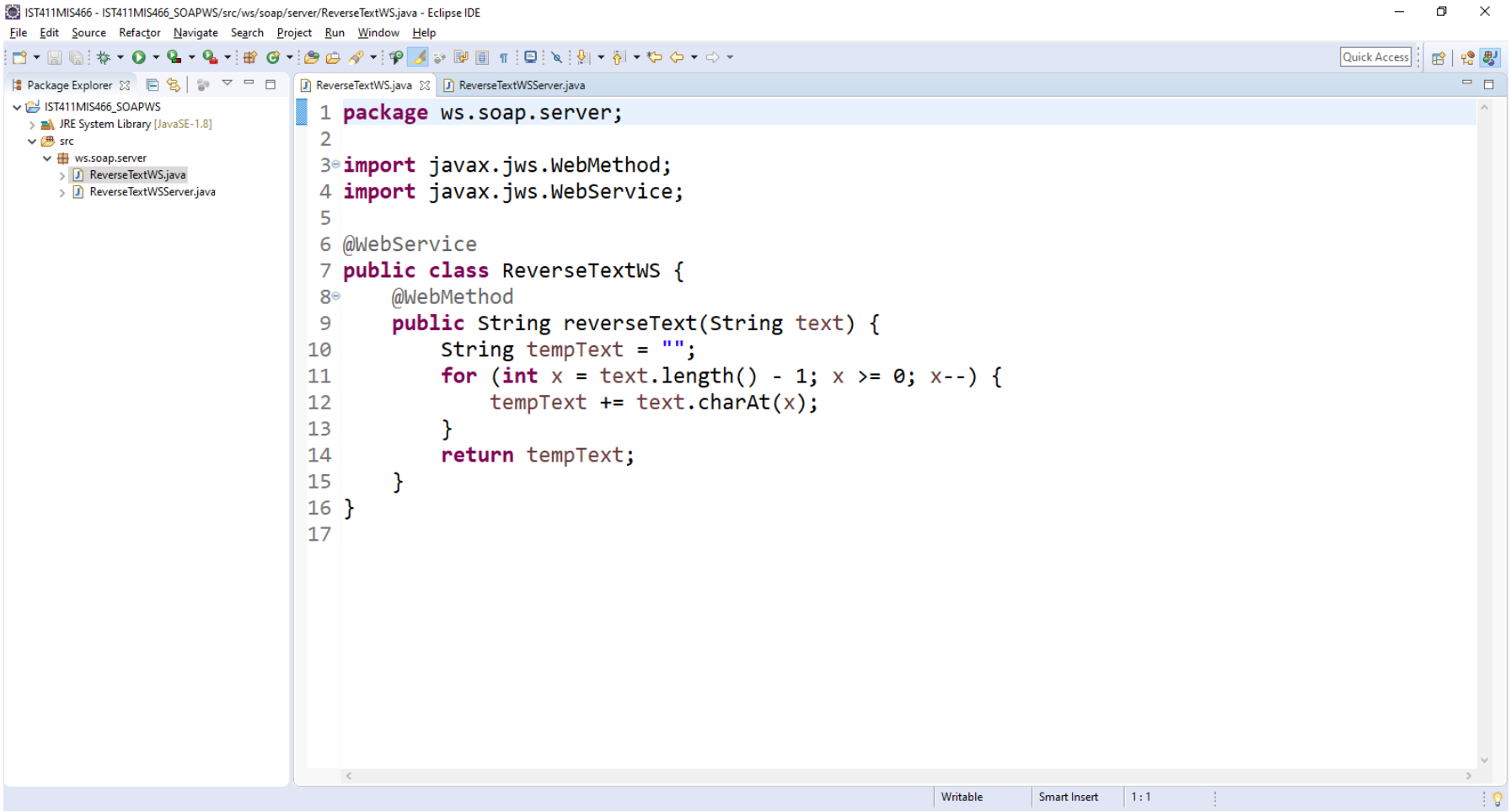


STEP 3: In the ***Eclipse IDE Launcher*** dialog, select (or enter) a directory that you want to use as your workspace. I created a folder called ***IST411MIS466_eclipse-workspace***, in the directory ***C:\Users\klk5059*** to use for my workspace. Click the ***Launch*** button.

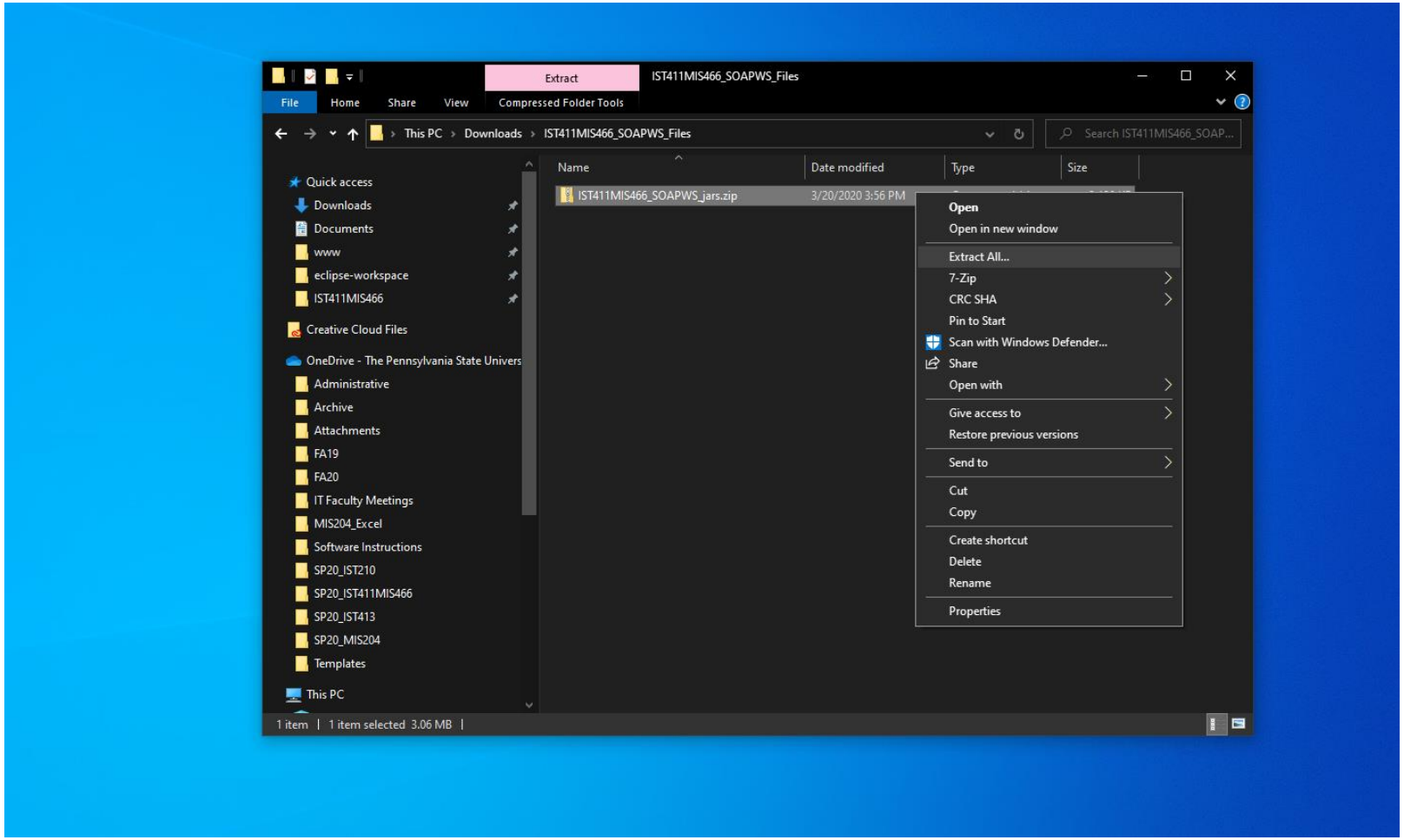


PART 3: CREATE THE WEB SERVICE CLASS

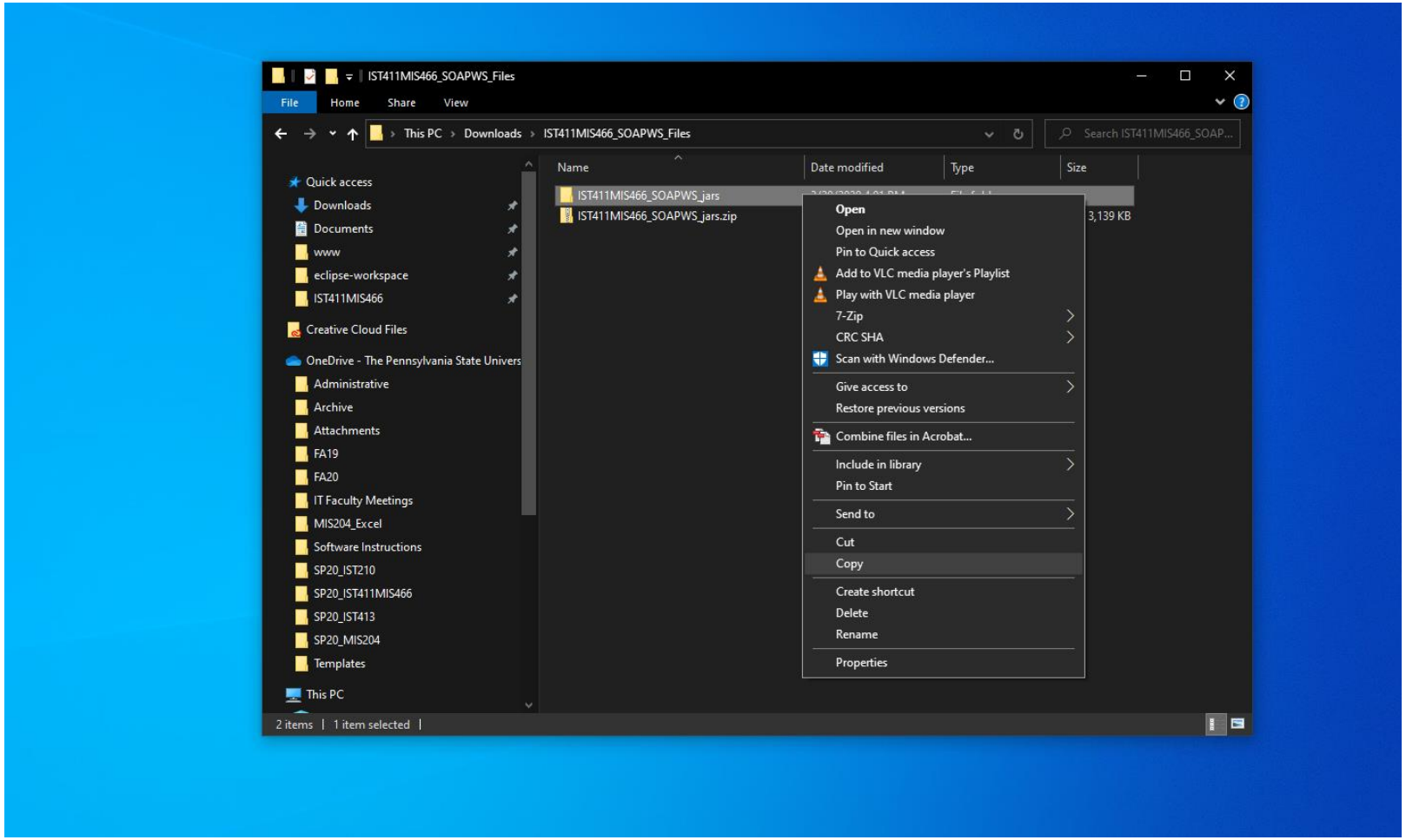
STEP 1: In a new Java project, create a new package called ***ws.soap.server***. In that package, create a new class called ***ReverseTextWS***, which will be the web service. Add the following code to the class. This class uses the annotations (indicated by the @ symbol). According to the Java documentation: "Annotations, a form of metadata, provide data about a program that is not part of the program itself. Annotations have no direct effect on the operation of the code they annotate." The ***@WebService*** annotation indicates that the class is a web service. The ***@WebMethod*** annotation indicates that the ***reverseText()*** method is exposed to web service clients. You will see errors on lines 3, 4, 6, and 8. We'll resolve those next.



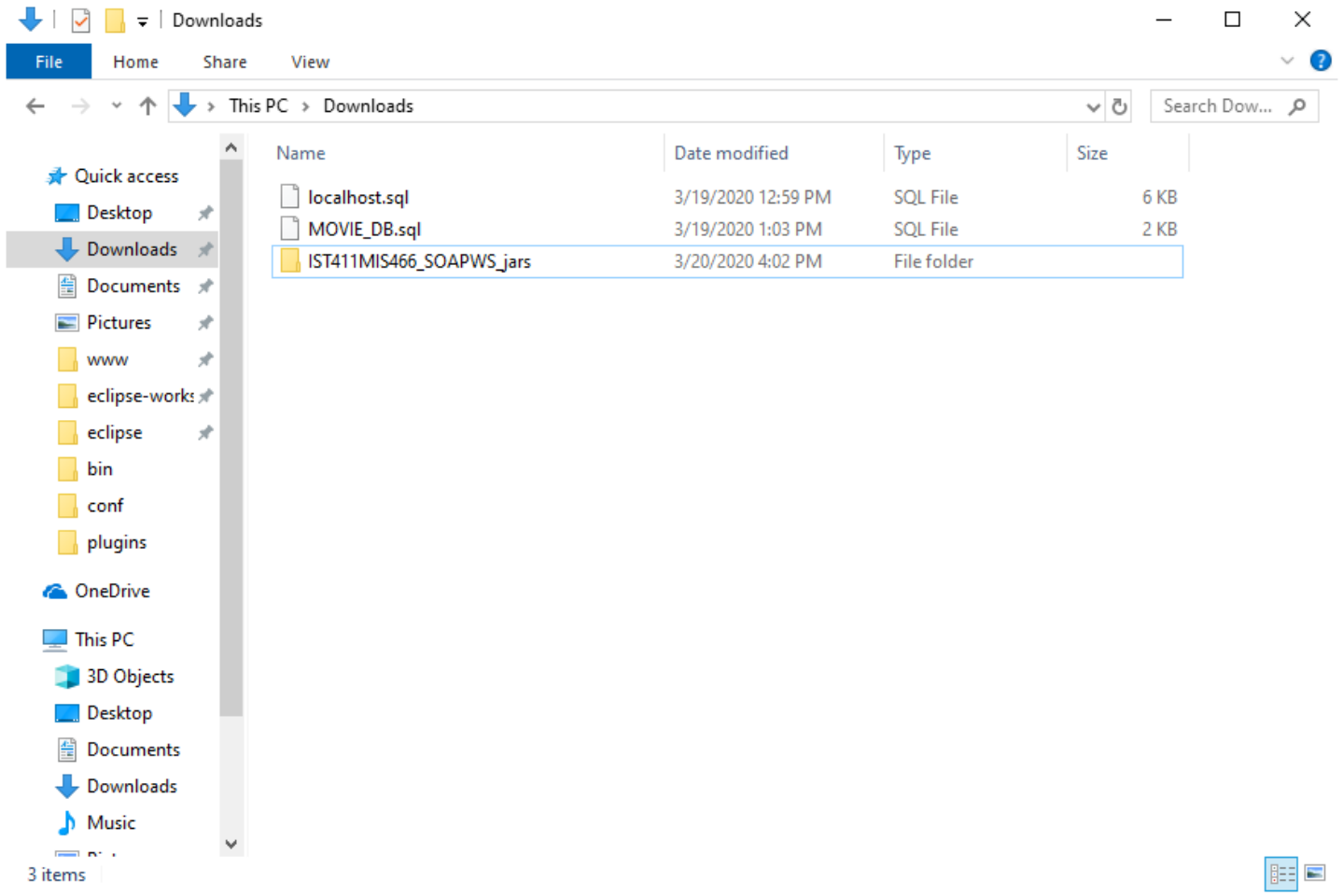
STEP 2: Download the IST411MIS466_SOAPWS_jars.zip folder from Canvas and extract its contents onto your computer.



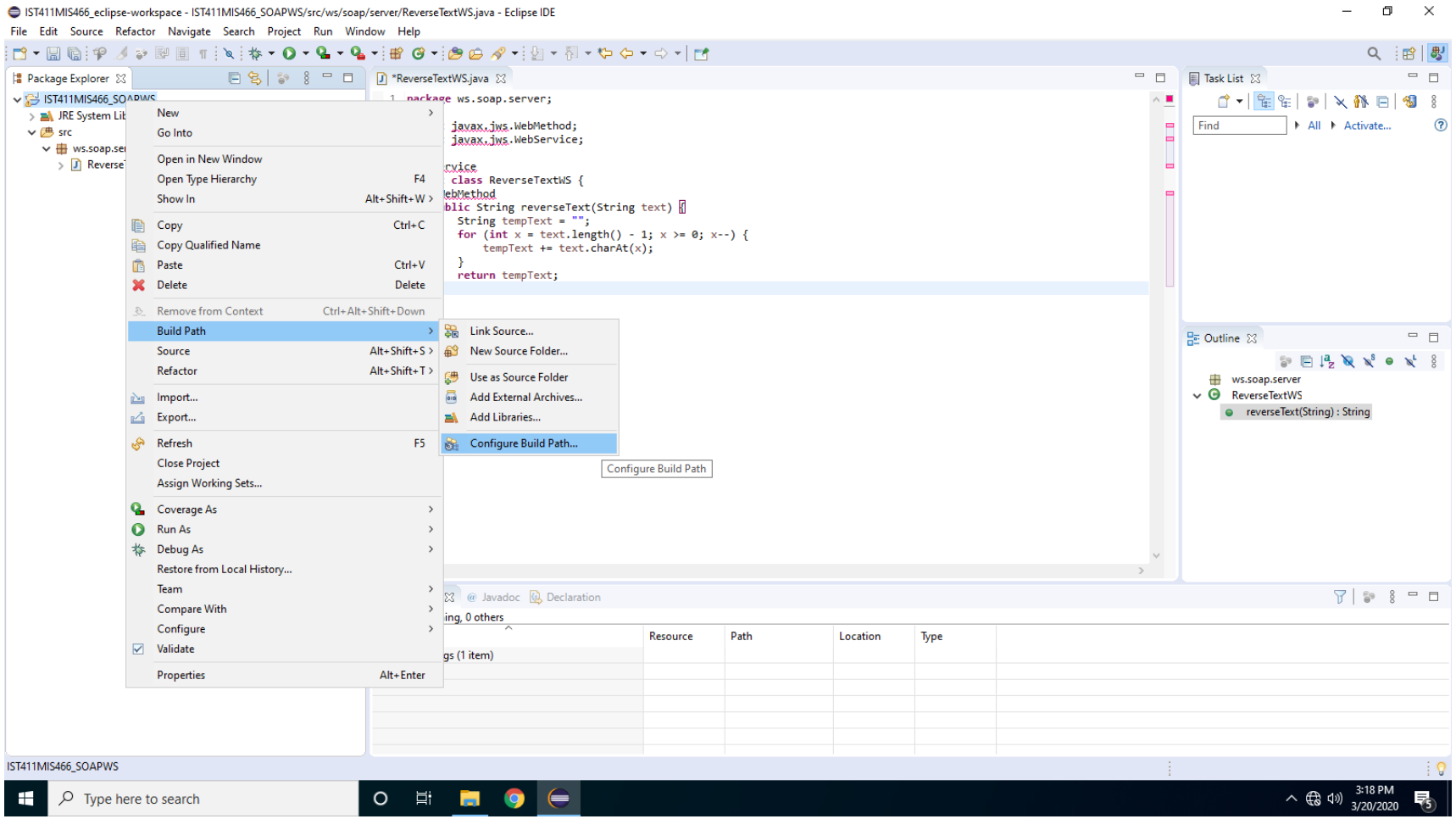
STEP 3: Copy the extracted folder.



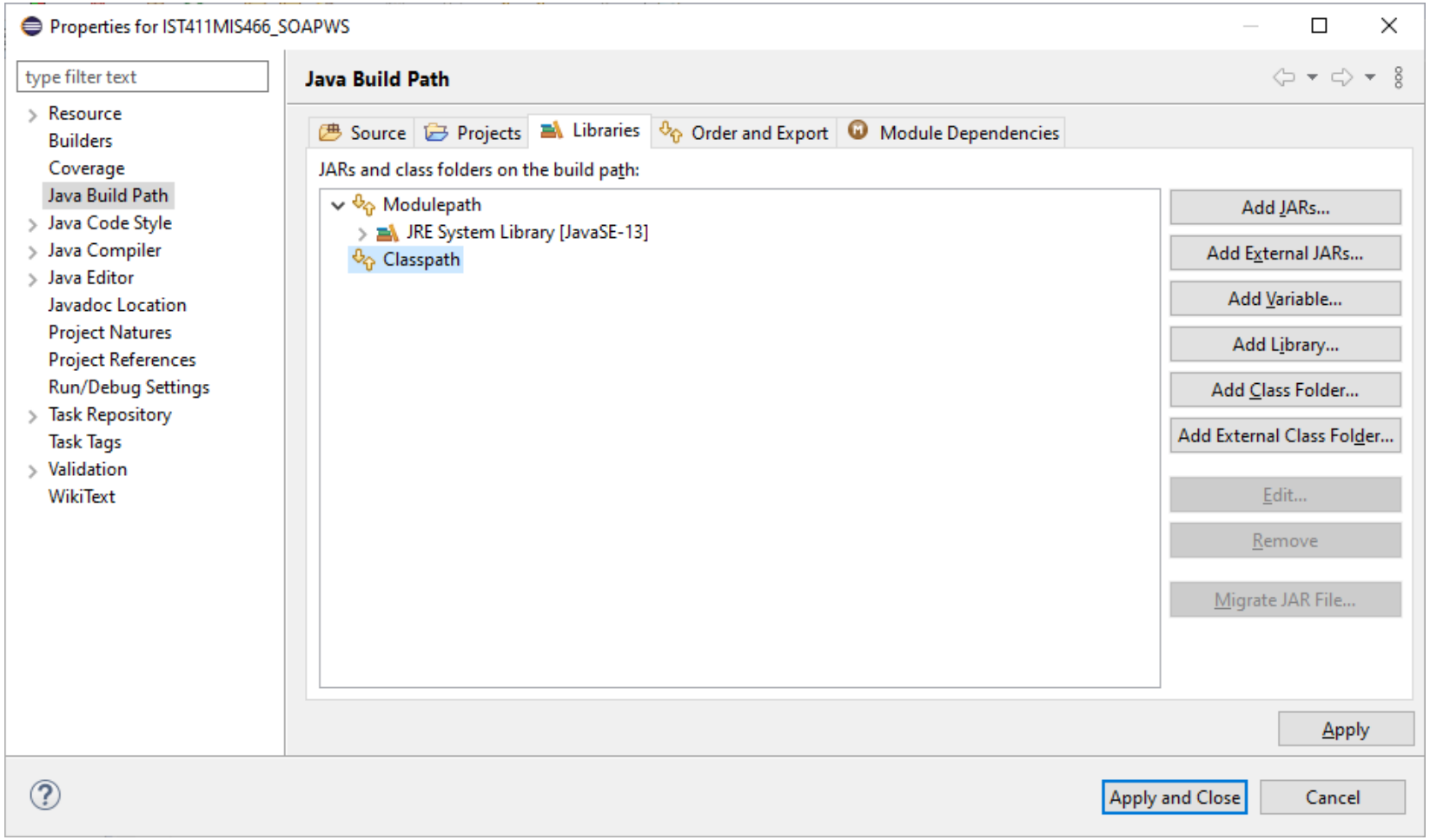
STEP 4: Back in your virtual machine, in a File Explorer window, open the ***Downloads*** directory. Paste the folder that you copied in the previous step.



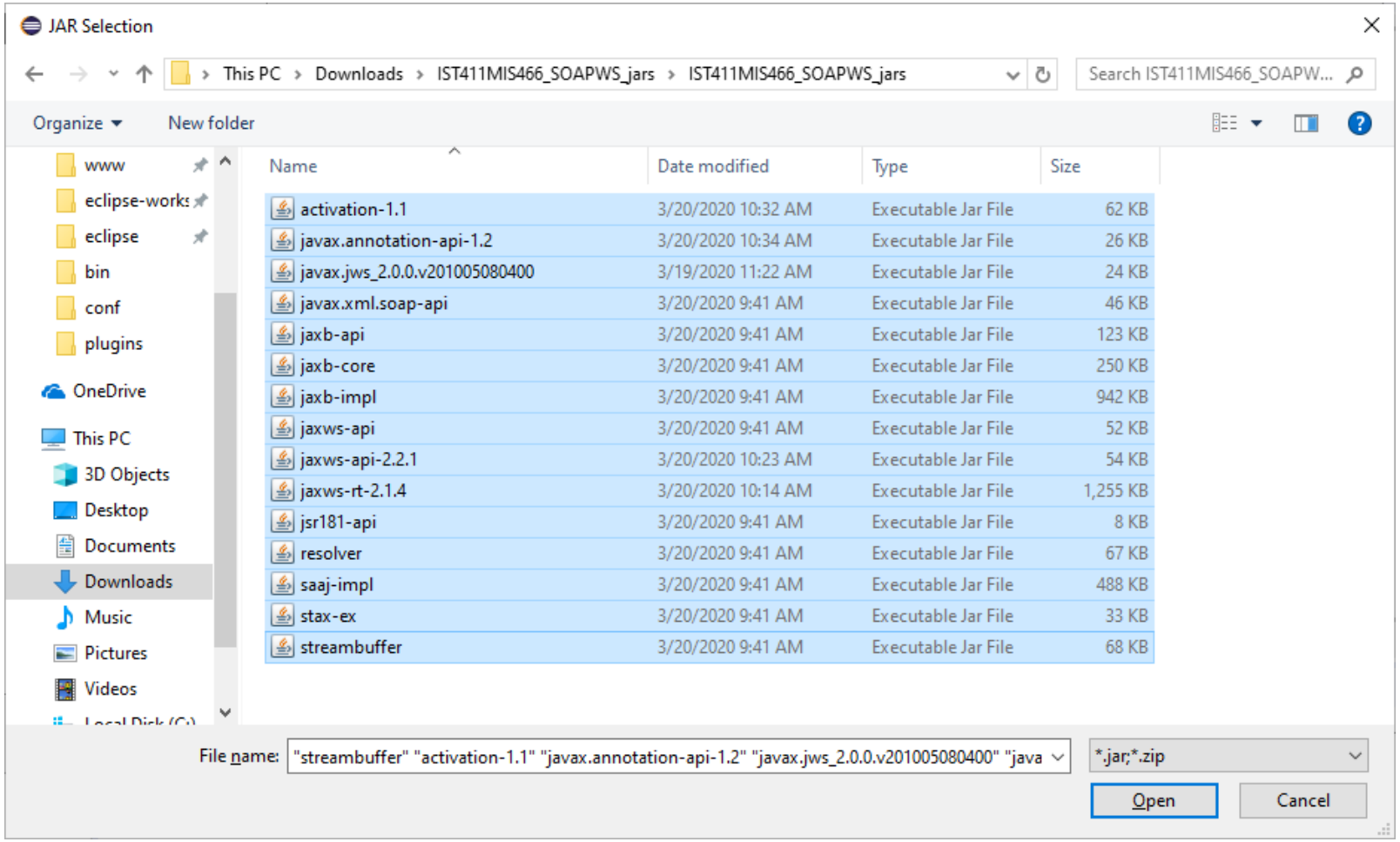
STEP 5: Back in Eclipse, right-click on the project and select ***Build Path***, then ***Configure Build Path…***.



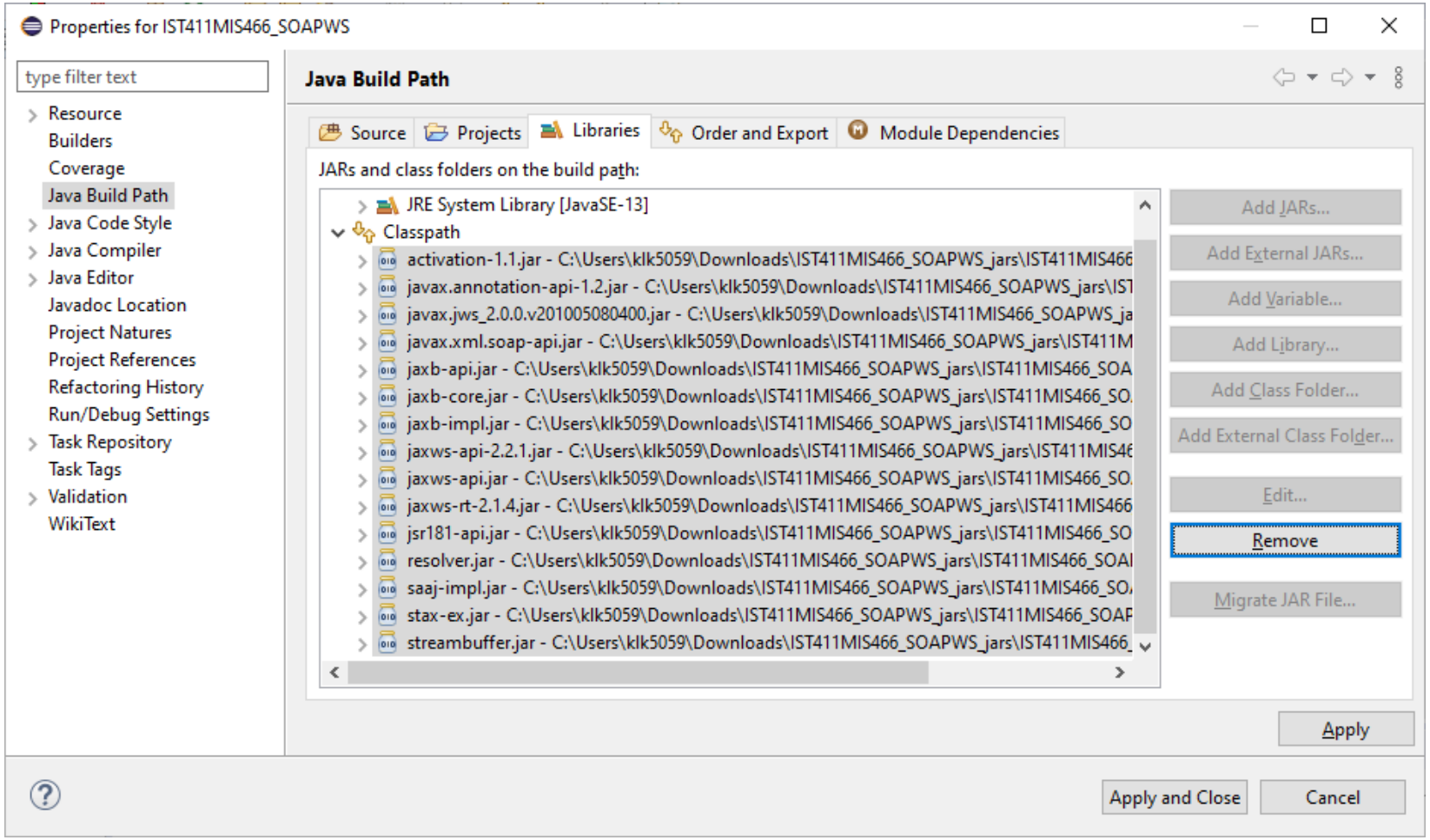
STEP 6: In the ***Properties for…*** dialog, select the ***Libraries*** tab, then click on ***Classpath***. Click the ***Add External JARs…*** button.



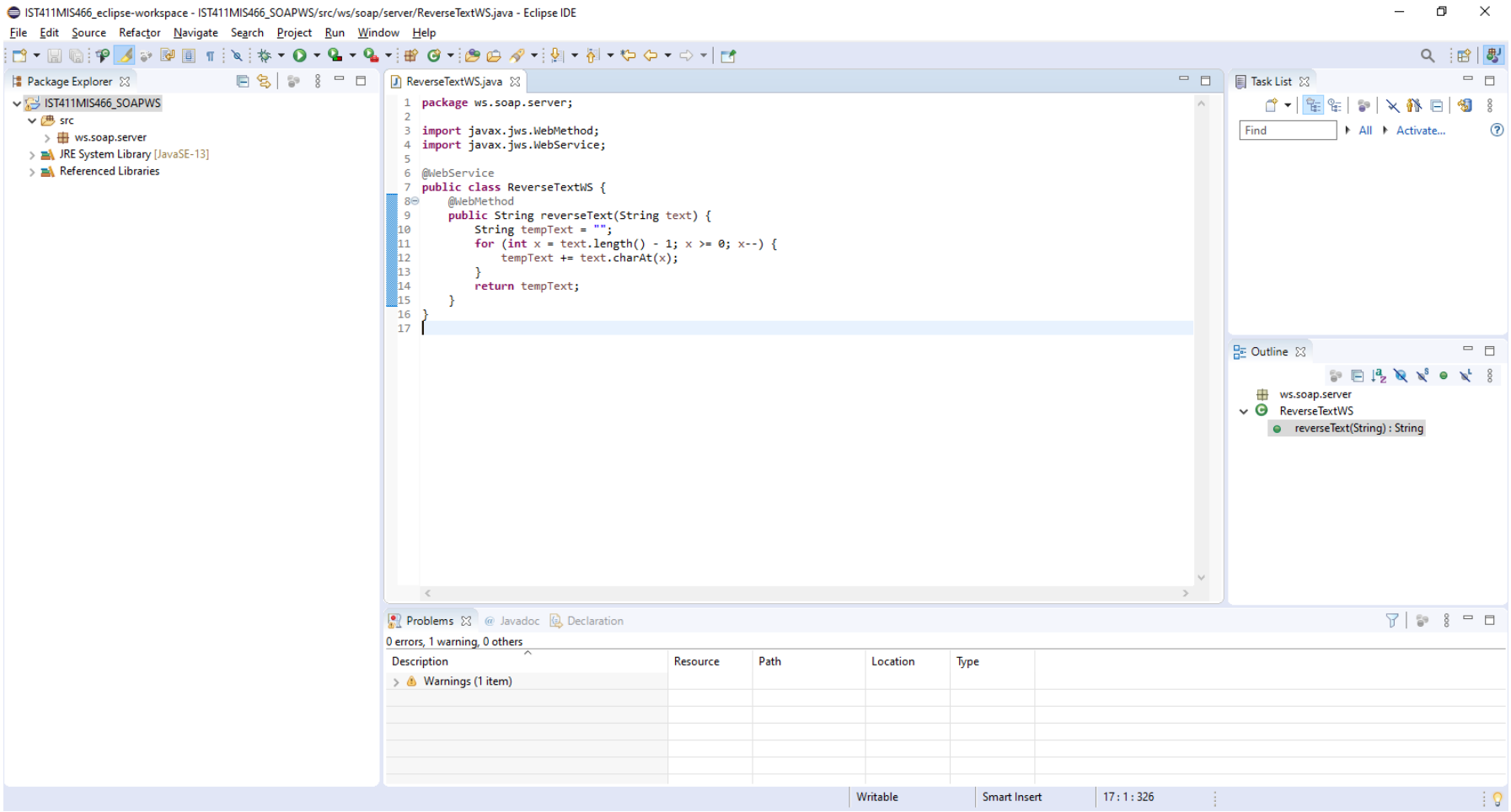
STEP 7: In the ***JAR Selection*** dialog, navigate to the ***Downloads\IST411MIS466_SOAPWS_jars*** directory and select the .jar files from the folder that you pasted there in STEP 4 (use the ***Shift*** key or the ***Ctrl*** key while selecting the .jar files to select all of them). Click the ***Open*** button.



STEP 8: Back in the ***Properties for…*** dialog, you should see all the .jar files listed under ***Classpath***. Click the ***Apply and Close*** button.

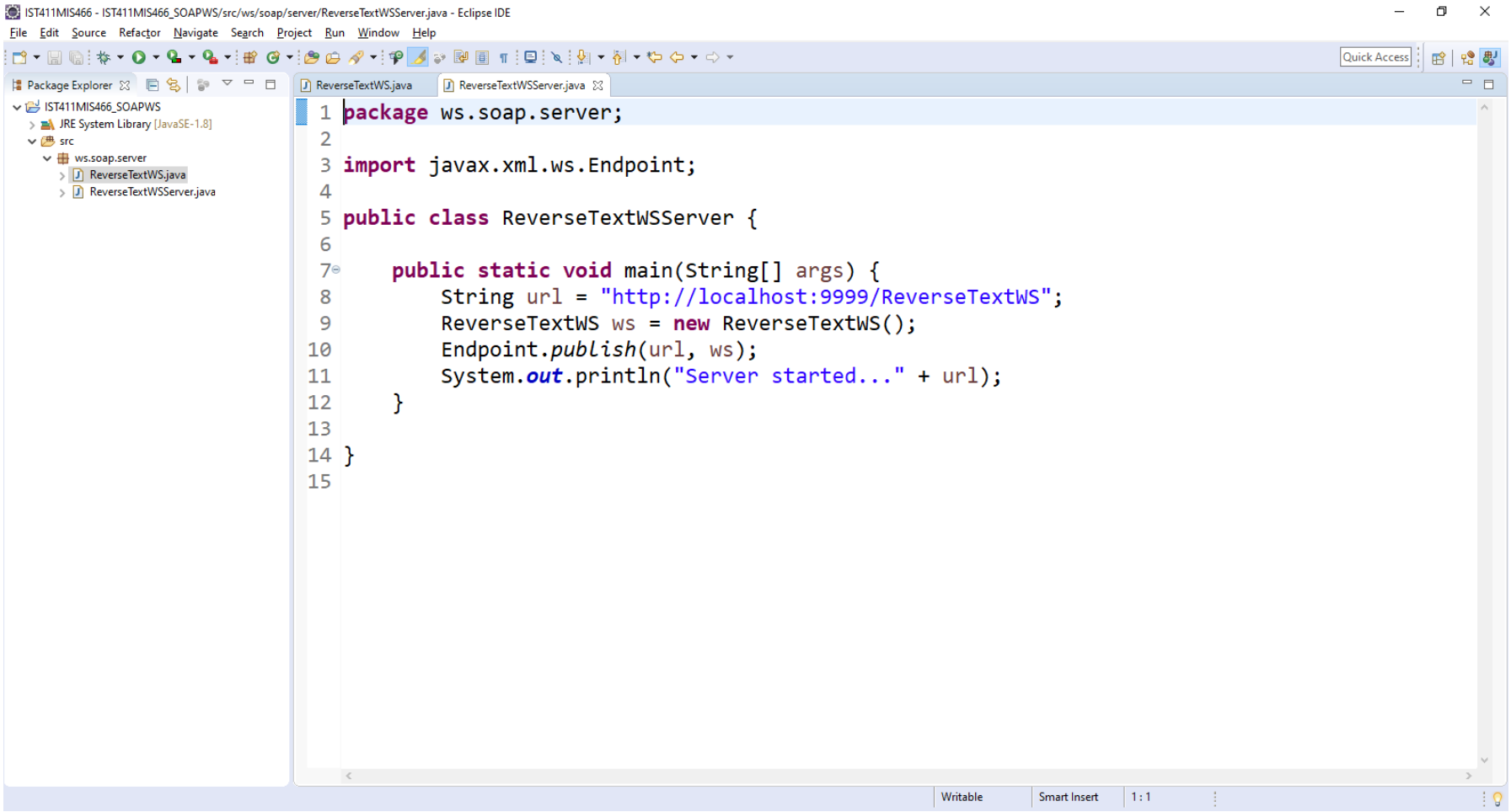


STEP 9: The errors in the ***ReverseTextWS.java*** file should now be resolved.



PART 2: CREATE THE WEB SERVICE SERVER

STEP 1: In the same package (***ws.soap.server***), create another class called ***ReverseTextWSServer***, which will be the web service server and will host the ***ReverseTextWS*** web service. Add the following code to the class. The ***url*** variable is where the web service will be published. We will publish it to the ***localhost*** on port ***9999*** as a resource called ***ReverseTextWS***. Next, we create the web service that will be published as an instance of ***ReverseTextWS***. Finally, we call the ***Endpoint.publish()*** method to create the endpoint, or the address from which the web service can be accessed by the clients.



PART 3: PUBLISH THE WEB SERVICE TO THE SERVER

STEP 1: Run the ***ReverseTextWSServer*** class. In the console you may see warning/info messages about deprecated libraries/classes. The last line of the console should display ***Server started…http://localhost:9999/ReverseTextWS***. Then in a browser, go to: http://localhost:9999/ReverseTextWS?wsdl. You should see the WSDL for the ***ReverseTextWS*** web service.

Problems | @ Javadoc | Declaration | Console

```
ReverseTextWSServer [Java Application] C:\Program Files\Java\jdk-14\bin\javaw.exe (Mar 20, 2020, 4:06:30 PM)
}
Mar 20, 2020 4:06:31 PM com.sun.xml.ws.model.RuntimeModeler getResponseWrapperClass
INFO: Dynamically creating response wrapper bean Class ws.soap.server.jaxws.ReverseTextResponse
Mar 20, 2020 4:06:31 PM com.sun.xml.ws.model.WrapperBeanGenerator createBeanImage
INFO:
@XmlRootElement(name=reverseTextResponse, namespace=http://server.soap.ws/)
@XmlType(name=reverseTextResponse, namespace=http://server.soap.ws/
public class ws.soap.server.jaxws.ReverseTextResponse {

    @XmlRootElement(name=return, namespace=)
    public Ljava/lang/String; _return

}
Server started...http://localhost:9999/ReverseTextWS
```

localhost:9999/ReverseTextWS?w

localhost:9999/ReverseTextWS?wsdl

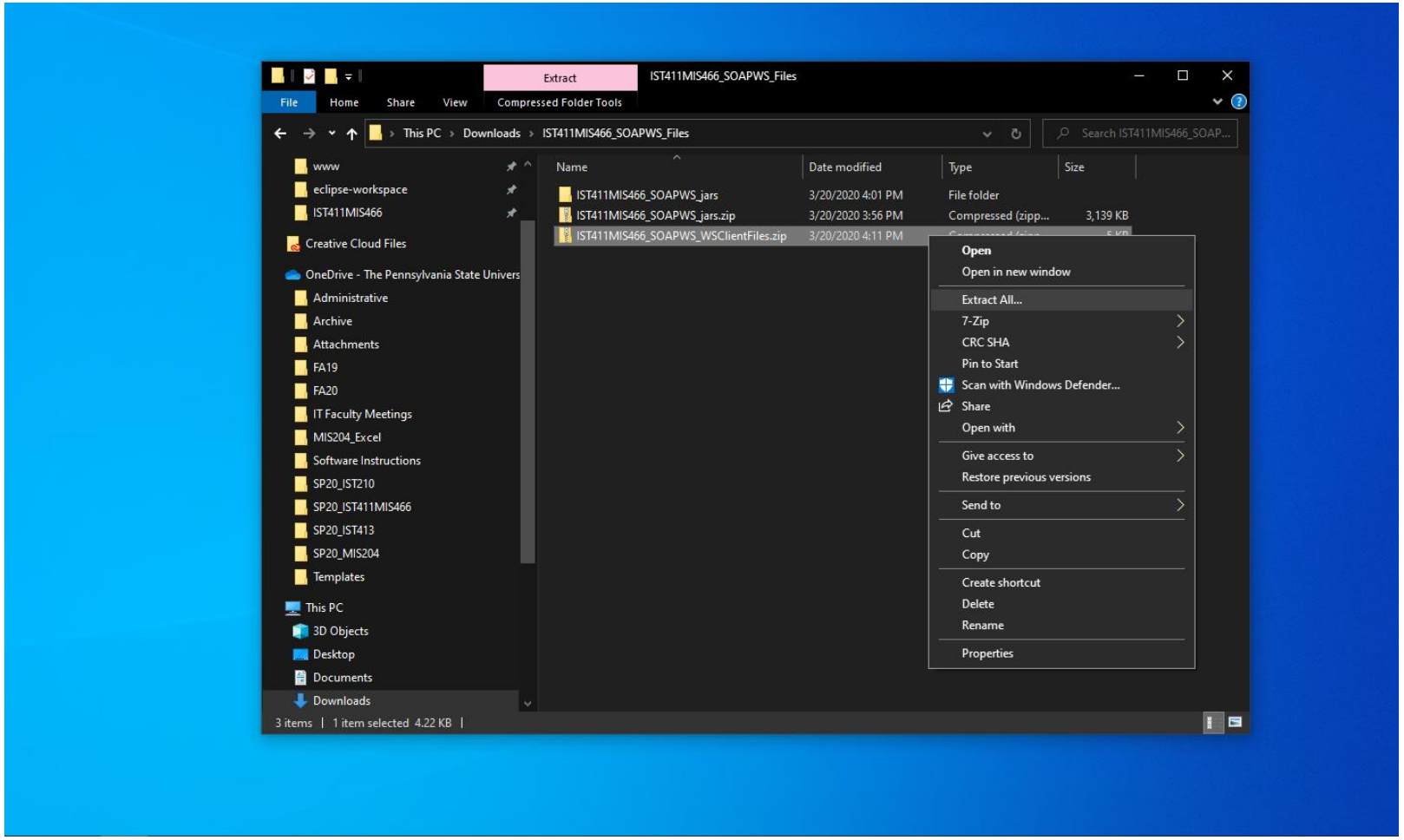
Apps | Messages | localhost | phpMyAdmin | PSU | Drive | Keep | Gmail | Amazon | Amazon Music | Amazon Photos | Facebook | Pinterest | Instagram | LinkedIn | Other bookmarks

This XML file does not appear to have any style information associated with it. The document tree is shown below.

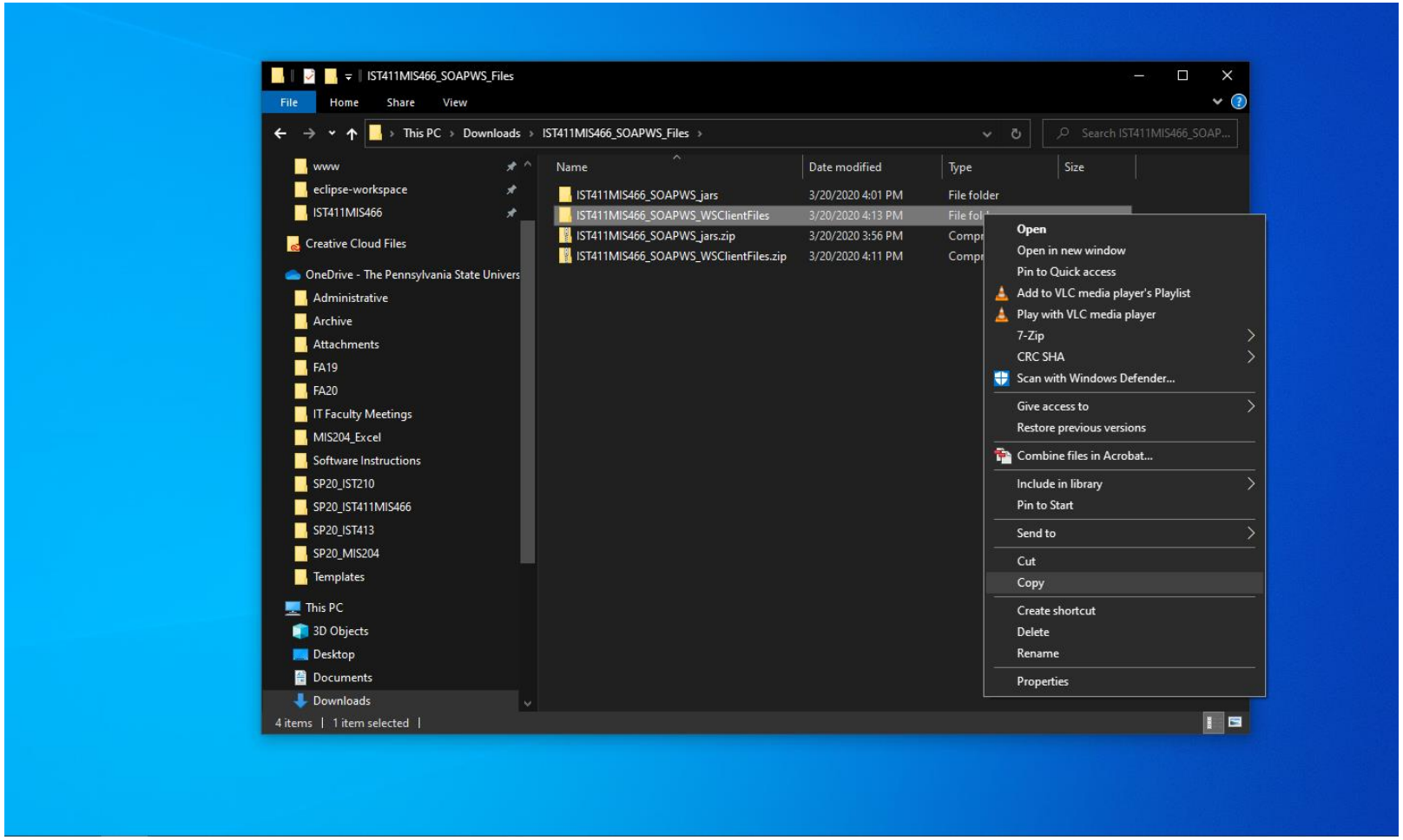
```
▼<!--
    Published by JAX-WS RI (http://jax-ws.java.net). RI's version is JAX-WS RI 2.2.9-b130926.1035 svn-revision#5f6196f2b90e9460065a4c2f4e30e065b245e51e.
 -->
▼<!--
    Generated by JAX-WS RI (http://jax-ws.java.net). RI's version is JAX-WS RI 2.2.9-b130926.1035 svn-revision#5f6196f2b90e9460065a4c2f4e30e065b245e51e.
 -->
▼<definitions xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd" xmlns:wsp="http://www.w3.org/ns/ws-policy" xmlns:wsp1_2="http://schemas.xmlsoap.org/ws/2004/09/policy"
 xmlns:wsam="http://www.w3.org/2007/05/addressing/metadata" xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/" xmlns:tns="http://server.soap.ws/" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
 xmlns="http://schemas.xmlsoap.org/wsdl/" targetNamespace="http://server.soap.ws/" name="ReverseTextWSService">
  ▼<types>
    ▼<xsd:schema>
       <xsd:import namespace="http://server.soap.ws/" schemaLocation="http://localhost:9999/ReverseTextWS?xsd=1"/>
     </xsd:schema>
   </types>
  ▼<message name="reverseText">
     <part name="parameters" element="tns:reverseText"/>
   </message>
  ▼<message name="reverseTextResponse">
     <part name="parameters" element="tns:reverseTextResponse"/>
   </message>
  ▼<portType name="ReverseTextWS">
    ▼<operation name="reverseText">
       <input wsam:Action="http://server.soap.ws/ReverseTextWS/reverseTextRequest" message="tns:reverseText"/>
       <output wsam:Action="http://server.soap.ws/ReverseTextWS/reverseTextResponse" message="tns:reverseTextResponse"/>
     </operation>
   </portType>
  ▼<binding name="ReverseTextWSPortBinding" type="tns:ReverseTextWS">
     <soap:binding transport="http://schemas.xmlsoap.org/soap/http" style="document"/>
    ▼<operation name="reverseText">
       <soap:operation soapAction=""/>
      ▼<input>
         <soap:body use="literal"/>
       </input>
      ▼<output>
         <soap:body use="literal"/>
       </output>
     </operation>
   </binding>
  ▼<service name="ReverseTextWSService">
    ▼<port name="ReverseTextWSPort" binding="tns:ReverseTextWSPortBinding">
       <soap:address location="http://localhost:9999/ReverseTextWS"/>
     </port>
   </service>
 </definitions>
```

PART 4: CREATE THE WEB SERVICE CLIENT FILES AND THE WEB SERVICE CLIENT

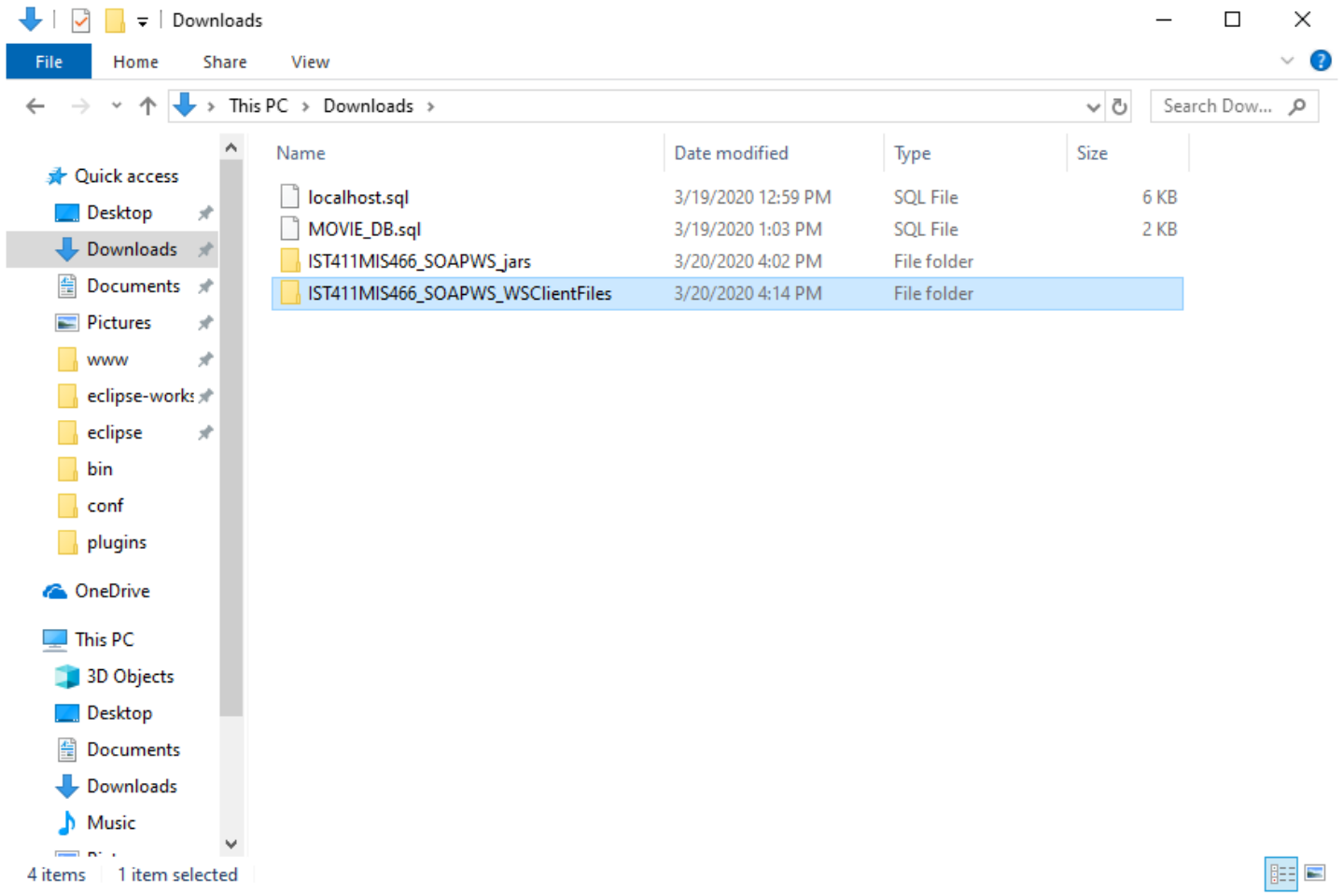
STEP 1: Download the IST411MIS466_SOAPWS_WSClientsFiles.zip folder from Canvas and extract its contents onto your computer.



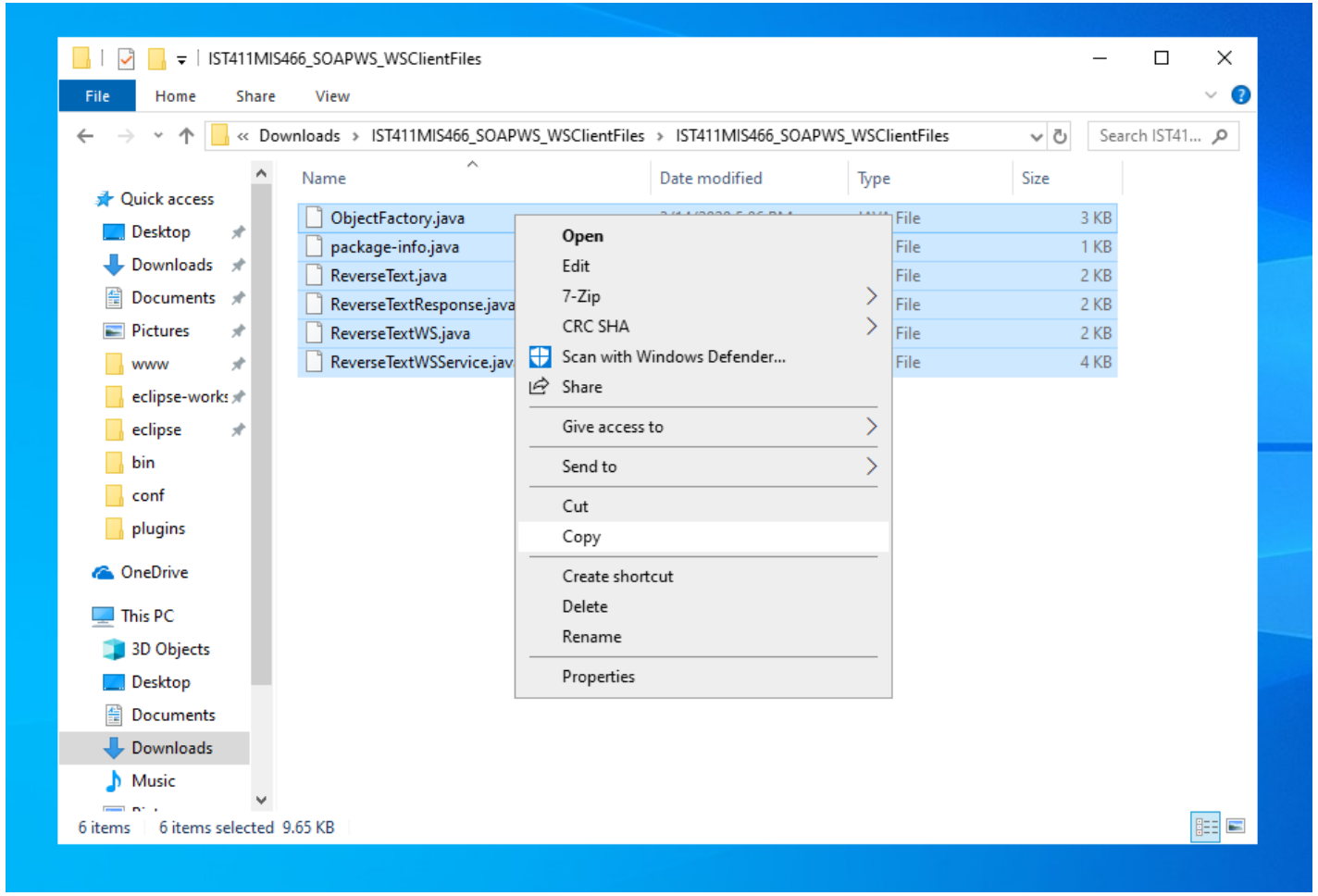
STEP 2: Copy the extracted folder.



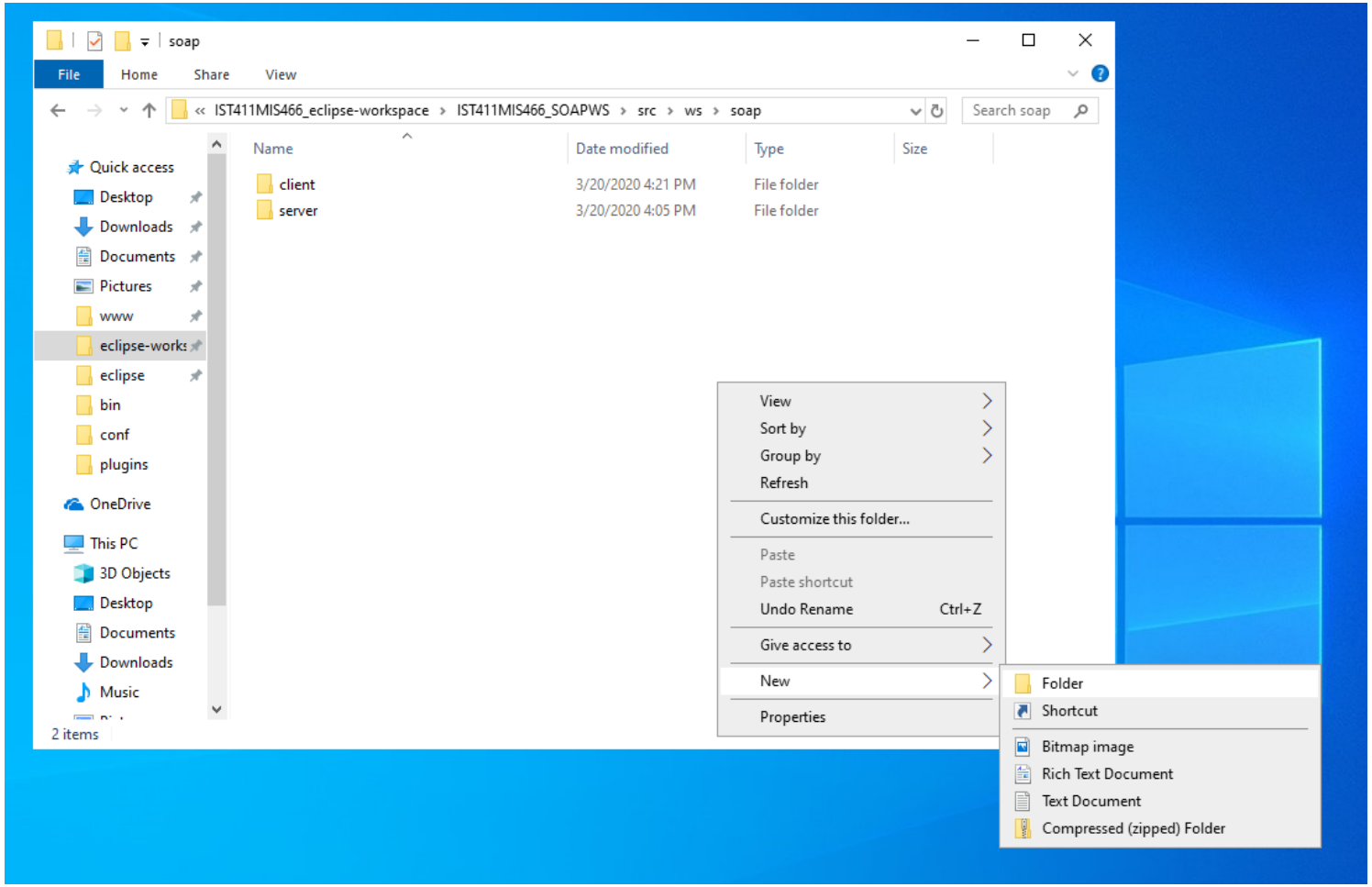
STEP 3: Back in your virtual machine, in a File Explorer window, open the ***Downloads*** directory. Paste the folder that you copied in the previous step.



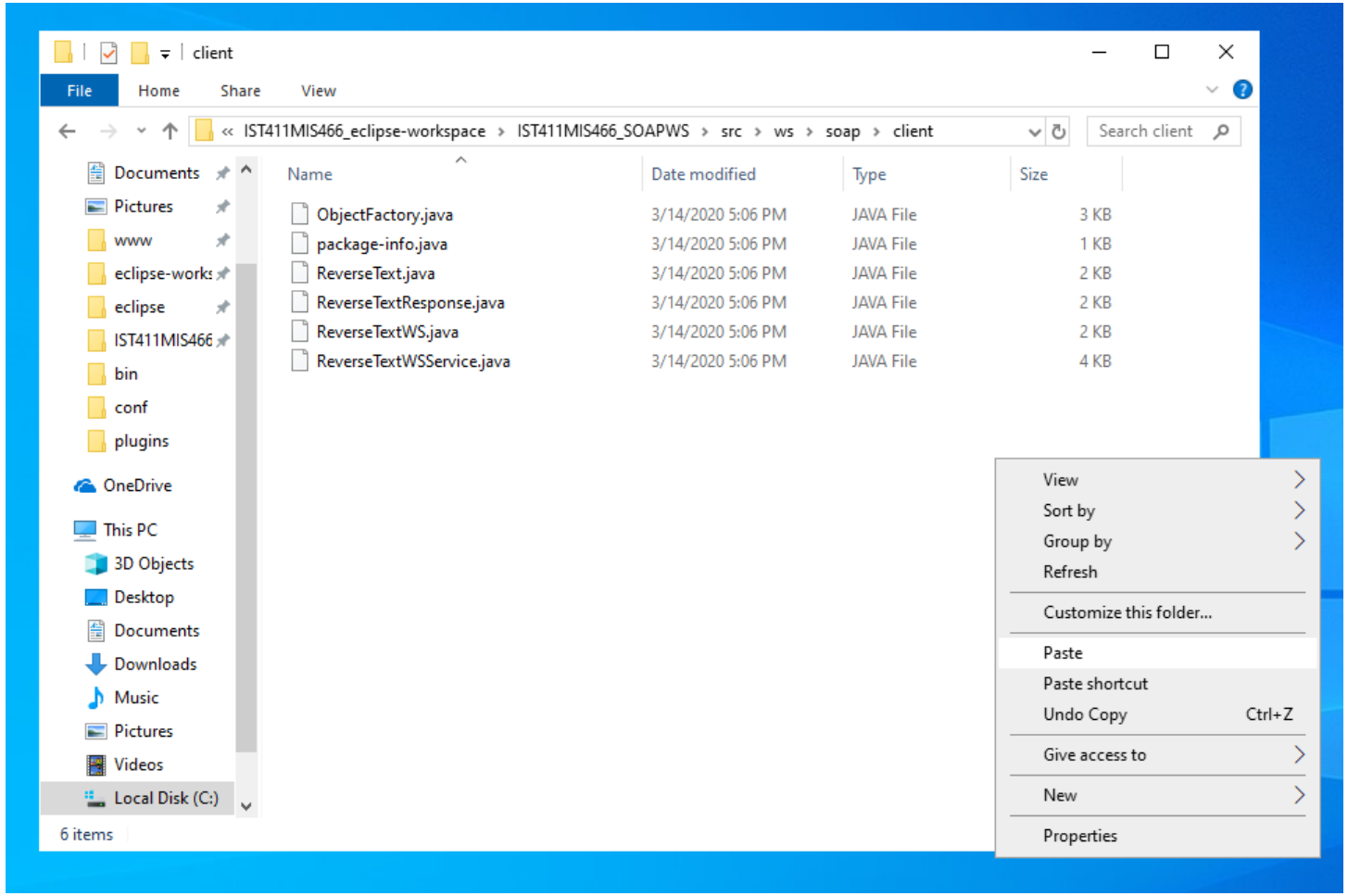
STEP 4: Open the ***Downloads\IST411MIS466_SOAPWS_WSClientFiles*** directory and copy the Java files. You should have a total of 6 files to copy (use the ***Shift*** key or the ***Ctrl*** key while selecting the .java files to select all of them).



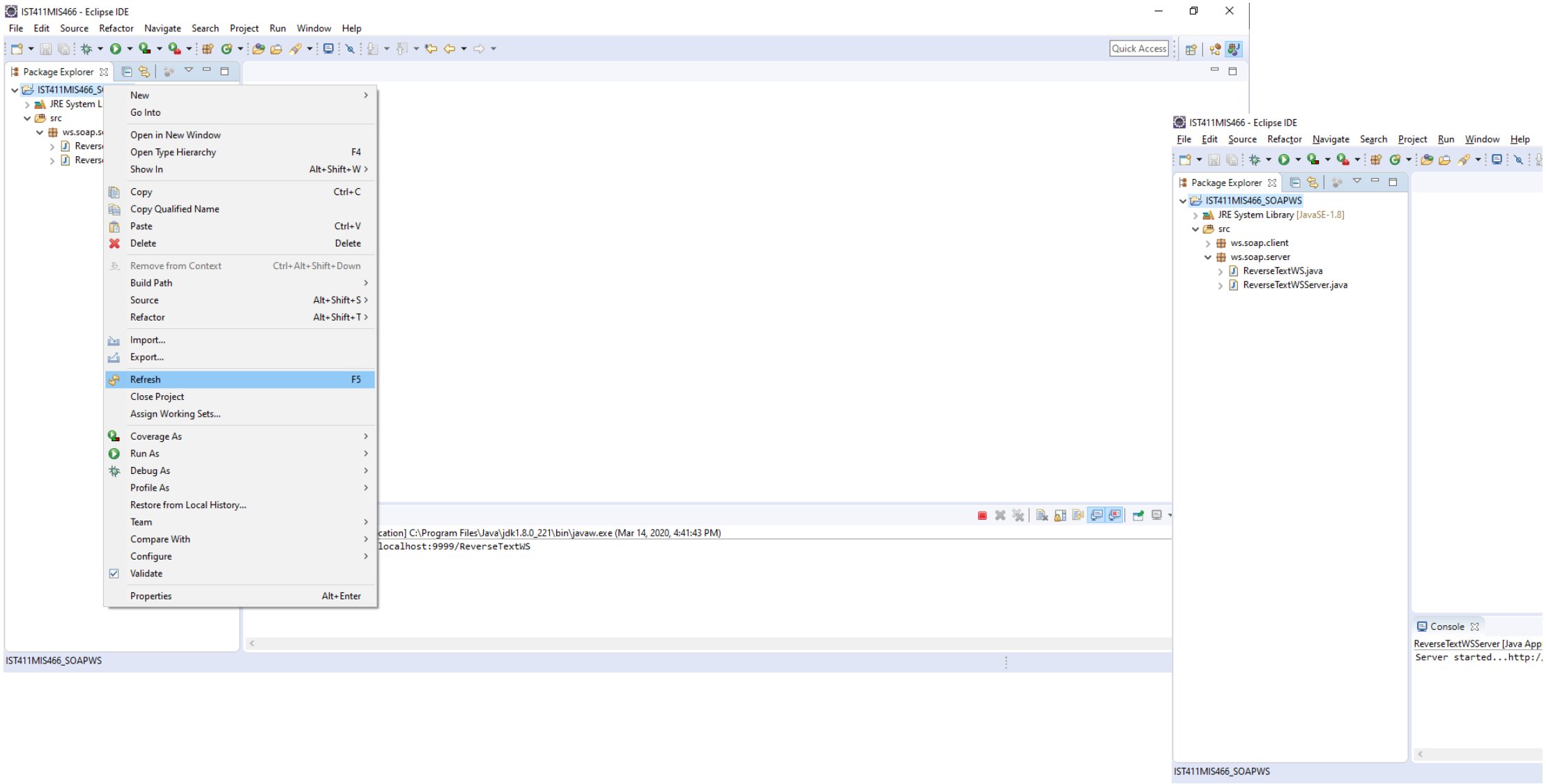
STEP 5: In a File Explorer window, navigate to your project (this should be your Eclipse workspace location, followed by your project name). Navigate into the ***src*** folder, then the ***ws*** folder, then the ***soap*** folder. In that directory, create a new folder named ***client***.



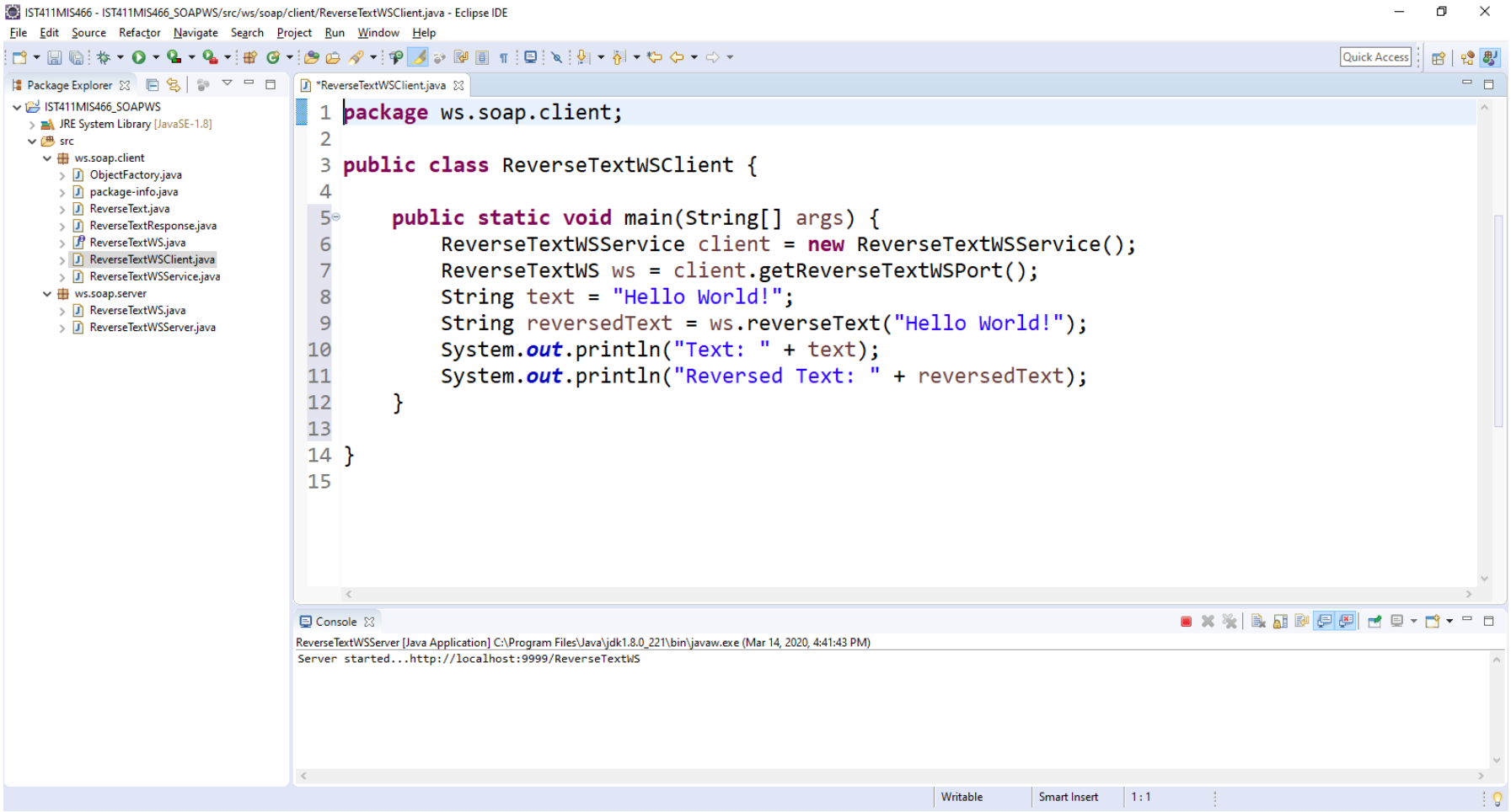
STEP 6: Navigate into the new client folder, and paste the Java files that you copied in STEP 4.



STEP 7: In Eclipse, right-click on the project and select ***Refresh Project***. You should now see a ***ws.soap.client*** package with all of the files that were generated from the ***wsimport*** Java command in STEP 4B.

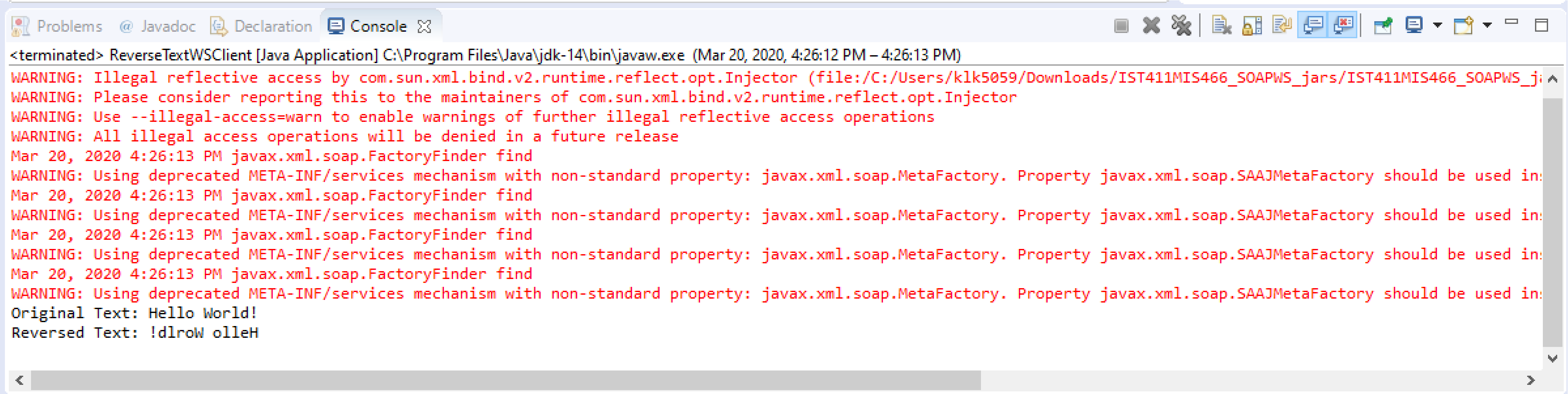


STEP 8: In the ***ws.soap.client*** package, create a new class called ***ReverseTextWSClient***, which will be the web service client. Add the following code to the class. We create a client view of the web service as an instance of ***ReverseTextWSService***, and use that to create the client web service interface as an instance of ***ReverseTextWS*** (the interface class in the client package that was generated by the ***wsimport*** Java command). This instance of the interface tells the client which methods the ***ReverseTextWS*** web service provides, which is why we use it to call the ***reverseText()*** method.



PART 5: RUN THE WEB SERVICE CLIENT

STEP 1: Run the ***ReverseTextWSClient*** class. In the console you may see warning/info messages about deprecated libraries/classes. The last lines of the console should display ***Text: Hello World!*** and ***Reversed Text: !dlroW olleH***. These are the original text value ***Hello World!*** and the reversed text value ***!dlroW olleH*** which was returned from the ***ReverseTextWS*** web service that is being hosted on the ***ReverseTextWSServer*** at ***localhost:9999/ReverseTextWS***.

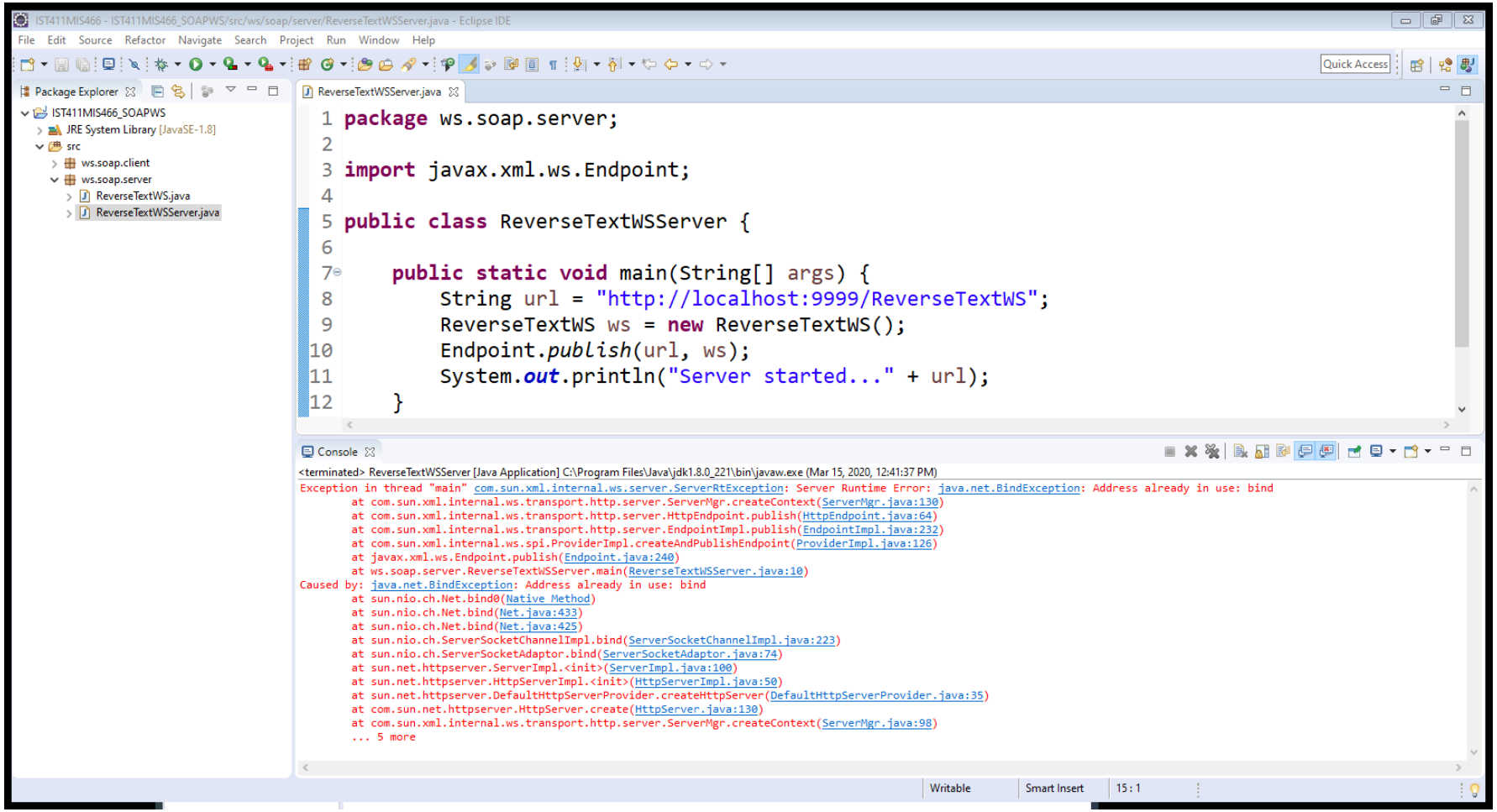


```
<terminated> ReverseTextWSClient [Java Application] C:\Program Files\Java\jdk-14\bin\javaw.exe  (Mar 20, 2020, 4:26:12 PM – 4:26:13 PM)
WARNING: Illegal reflective access by com.sun.xml.bind.v2.runtime.reflect.opt.Injector (file:/C:/Users/klk5059/Downloads/IST411MIS466_SOAPWS_jars/IST411MIS466_SOAPWS_j
WARNING: Please consider reporting this to the maintainers of com.sun.xml.bind.v2.runtime.reflect.opt.Injector
WARNING: Use --illegal-access=warn to enable warnings of further illegal reflective access operations
WARNING: All illegal access operations will be denied in a future release
Mar 20, 2020 4:26:13 PM javax.xml.soap.FactoryFinder find
WARNING: Using deprecated META-INF/services mechanism with non-standard property: javax.xml.soap.MetaFactory. Property javax.xml.soap.SAAJMetaFactory should be used in
Mar 20, 2020 4:26:13 PM javax.xml.soap.FactoryFinder find
WARNING: Using deprecated META-INF/services mechanism with non-standard property: javax.xml.soap.MetaFactory. Property javax.xml.soap.SAAJMetaFactory should be used in
Mar 20, 2020 4:26:13 PM javax.xml.soap.FactoryFinder find
WARNING: Using deprecated META-INF/services mechanism with non-standard property: javax.xml.soap.MetaFactory. Property javax.xml.soap.SAAJMetaFactory should be used in
Mar 20, 2020 4:26:13 PM javax.xml.soap.FactoryFinder find
WARNING: Using deprecated META-INF/services mechanism with non-standard property: javax.xml.soap.MetaFactory. Property javax.xml.soap.SAAJMetaFactory should be used in
Original Text: Hello World!
Reversed Text: !dlroW olleH
```

TROUBELSHOOTING

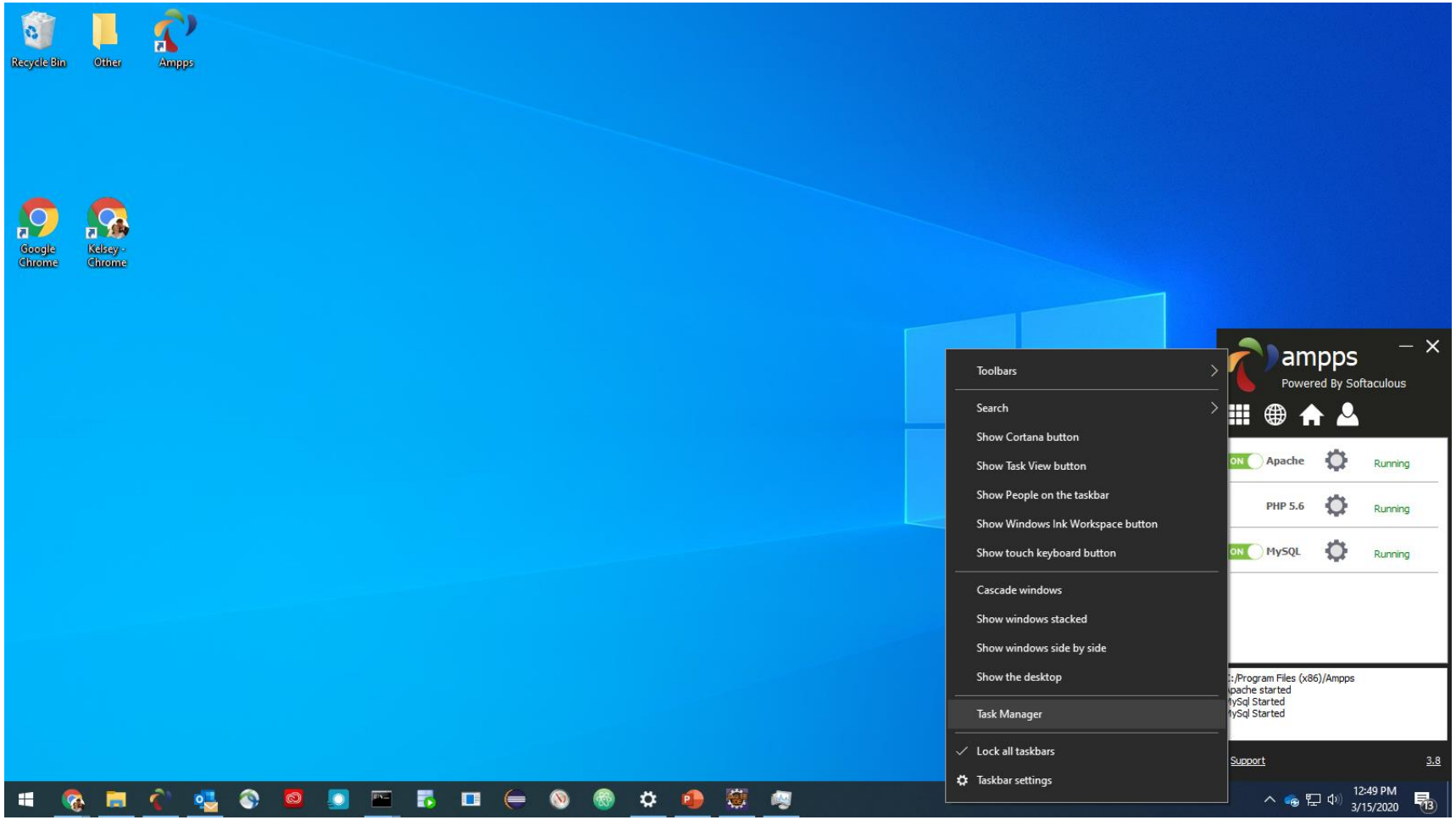
TROUBLESHOOTING THE SERVER:

When running the server component of this exercise, if you get a runtime error like the one shown below ***Address already in use: bind…*** you likely didn't stop a previous instance of the server from running. You can check the console in Eclipse to see if you can find the running instance and use the ***stop*** button to terminate the program. However, if you cannot find the programming in Eclipse you can follow these step to terminate the process and free the port.



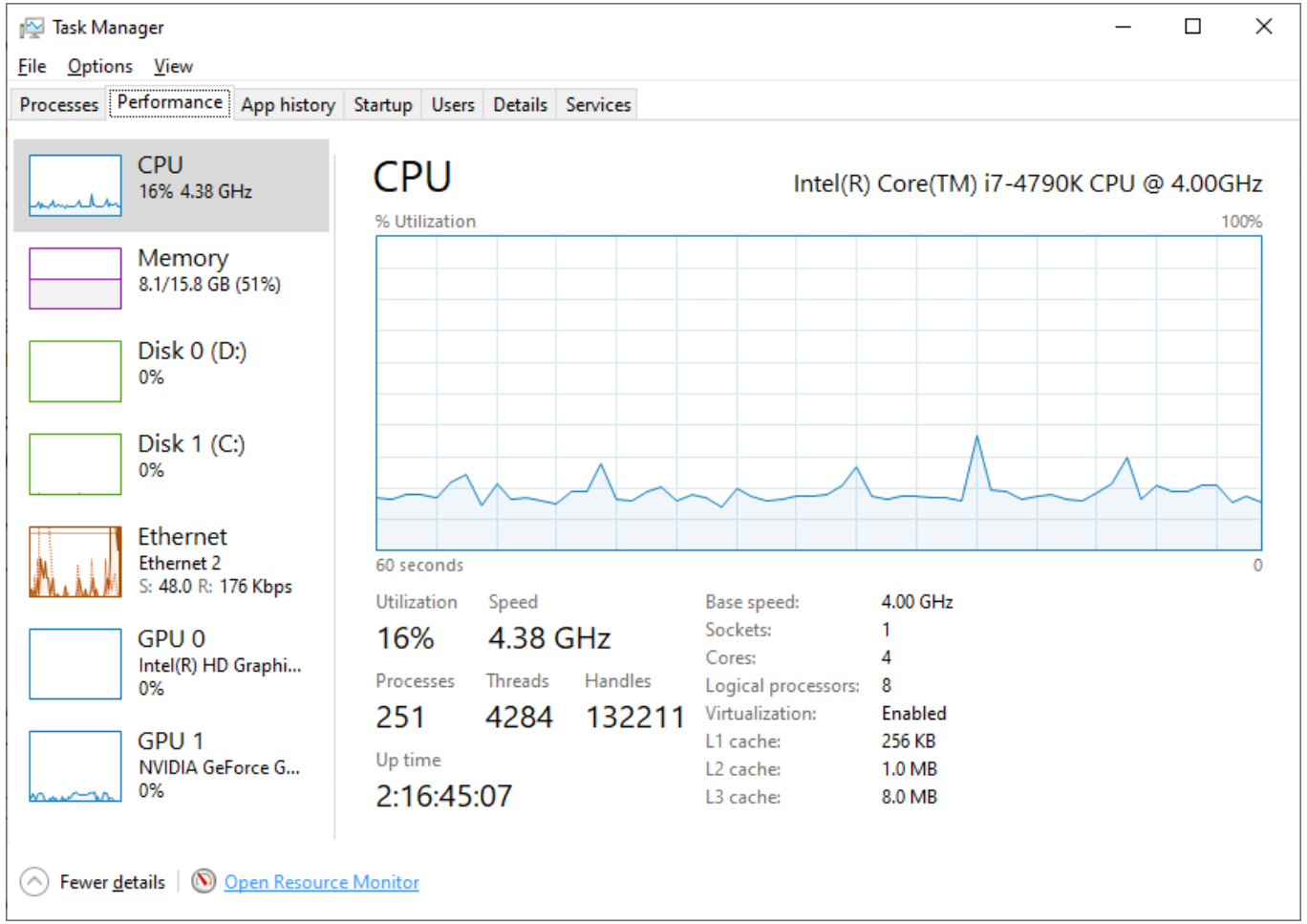
TROUBELSHOOTING THE SERVER

STEP 1: To terminate the server, you will need to use the Task Manager and the Resource Monitor. First, open your task manager. One way to do this is to right-click in the task bar and select ***Task Manager***.



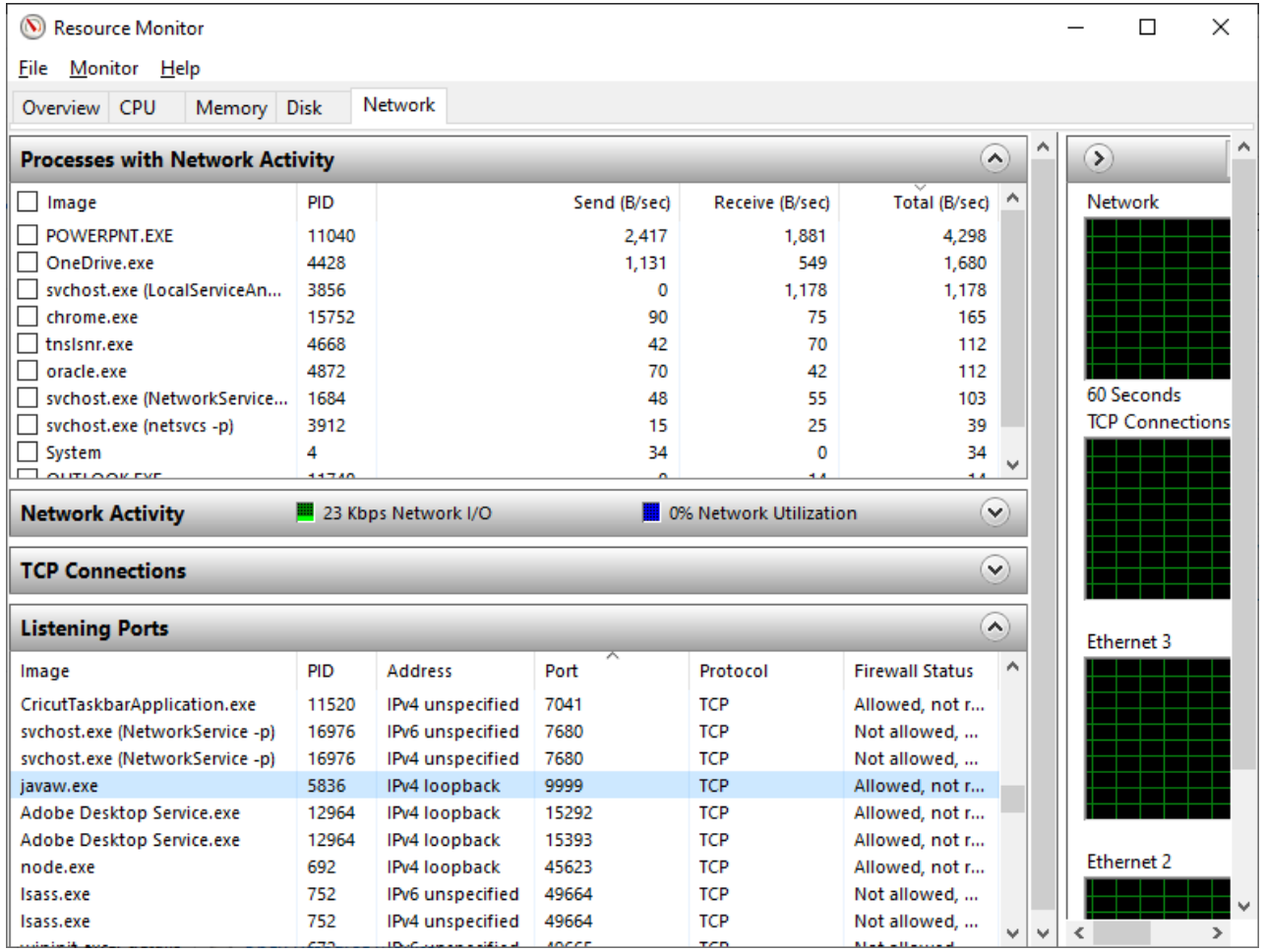
TROUBLESHOOTING THE SERVER

STEP 2: In the Task Manager, select the ***Performance*** tab. At the bottom of the window, click on ***Open Resource Monitor***.



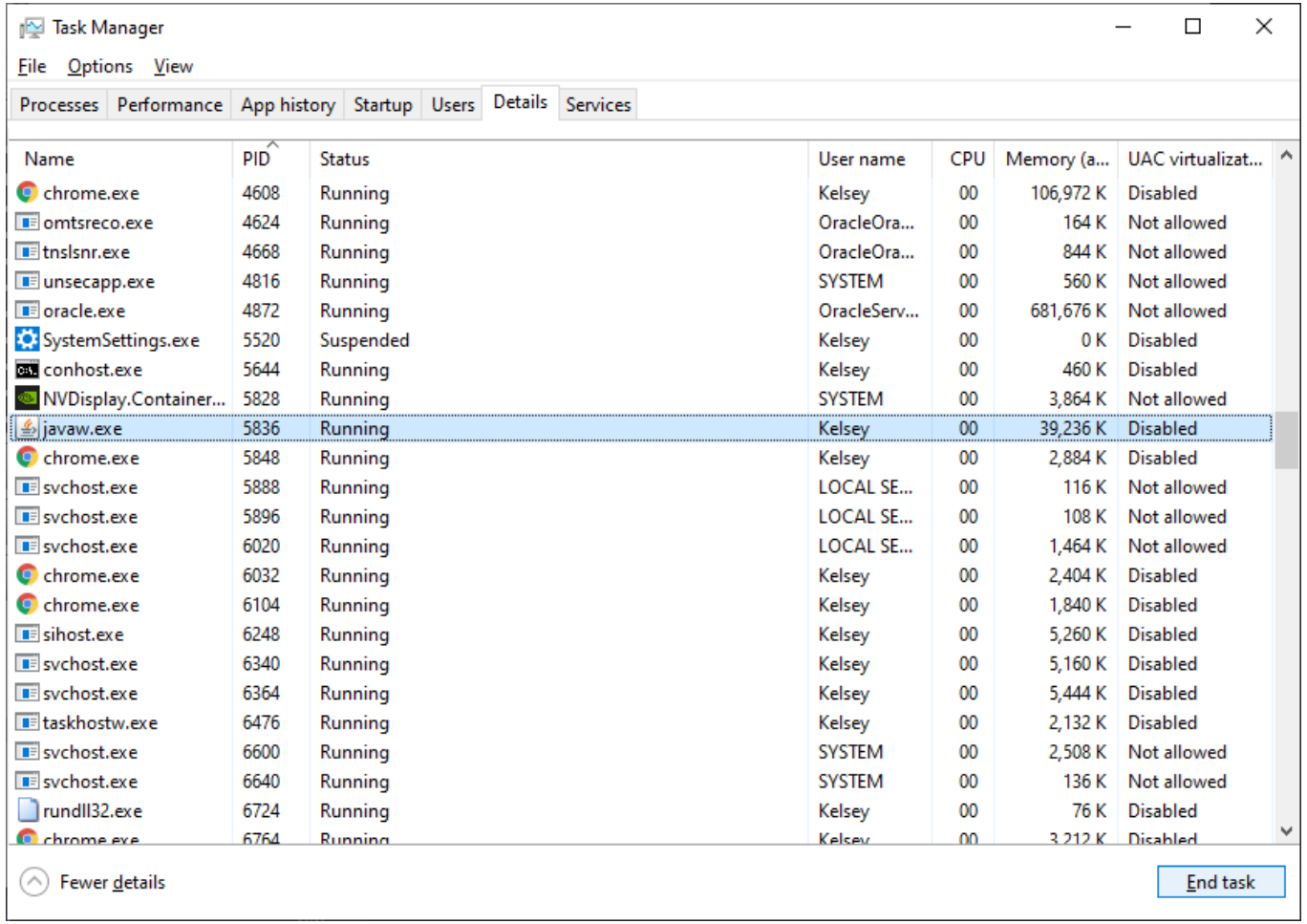
TROUBLESHOOTING THE SERVER

STEP 3: In the Resource Monitor, in the ***Listening Ports*** section, find the port for the server (in this example it's 9999). You can sort the ports in numeric order by click the ***Port*** column heading. When you find the port, make a note of the ***PID***. In this case, it's 5836.



TROUBLESHOOTING THE SERVER

STEP 4: Return to the Task Manager, and select the ***Details*** tab. Locate the process by finding the ***PID*** that you made a note of in the previous step. Again, you can sort the processes numerically by clicking on the ***PID*** column header. When you locate the process, click on it (the row should be highlighted) and then click the ***End task*** button.



Name	PID	Status	User name	CPU	Memory (a...	UAC virtualizat...
chrome.exe	4608	Running	Kelsey	00	106,972 K	Disabled
omtsreco.exe	4624	Running	OracleOra...	00	164 K	Not allowed
tnslsnr.exe	4668	Running	OracleOra...	00	844 K	Not allowed
unsecapp.exe	4816	Running	SYSTEM	00	560 K	Not allowed
oracle.exe	4872	Running	OracleServ...	00	681,676 K	Not allowed
SystemSettings.exe	5520	Suspended	Kelsey	00	0 K	Disabled
conhost.exe	5644	Running	Kelsey	00	460 K	Disabled
NVDisplay.Container...	5828	Running	SYSTEM	00	3,864 K	Not allowed
javaw.exe	5836	Running	Kelsey	00	39,236 K	Disabled
chrome.exe	5848	Running	Kelsey	00	2,884 K	Disabled
svchost.exe	5888	Running	LOCAL SE...	00	116 K	Not allowed
svchost.exe	5896	Running	LOCAL SE...	00	108 K	Not allowed
svchost.exe	6020	Running	LOCAL SE...	00	1,464 K	Not allowed
chrome.exe	6032	Running	Kelsey	00	2,404 K	Disabled
chrome.exe	6104	Running	Kelsey	00	1,840 K	Disabled
sihost.exe	6248	Running	Kelsey	00	5,260 K	Disabled
svchost.exe	6340	Running	Kelsey	00	5,160 K	Disabled
svchost.exe	6364	Running	Kelsey	00	5,444 K	Disabled
taskhostw.exe	6476	Running	Kelsey	00	2,132 K	Disabled
svchost.exe	6600	Running	SYSTEM	00	2,508 K	Not allowed
svchost.exe	6640	Running	SYSTEM	00	136 K	Not allowed
rundll32.exe	6724	Running	Kelsey	00	76 K	Disabled
chrome.exe	6764	Running	Kelsey	00	3,212 K	Disabled

TROUBLESHOOTING THE SERVER

STEP 5: You can now try to run the server again in Eclipse. You should see the ***Server started…*** message in the console.

IST411MIS466 - IST411MIS466_SOAPWS/src/ws/soap/server/ReverseTextWSServer.java - Eclipse IDE

File Edit Source Refactor Navigate Search Project Run Window Help

Package Explorer

- IST411MIS466_SOAPWS
  - JRE System Library [JavaSE-1.8]
  - src
    - ws.soap.client
    - ws.soap.server
      - ReverseTextWS.java
      - ReverseTextWSServer.java

ReverseTextWSServer.java

```
1  package ws.soap.server;
2
3  import javax.xml.ws.Endpoint;
4
5  public class ReverseTextWSServer {
6
7      public static void main(String[] args) {
8          String url = "http://localhost:9999/ReverseTextWS";
9          ReverseTextWS ws = new ReverseTextWS();
10         Endpoint.publish(url, ws);
11         System.out.println("Server started..." + url);
12     }
```

Console

ReverseTextWSServer [Java Application] C:\Program Files\Java\jdk1.8.0_221\bin\javaw.exe (Mar 15, 2020, 12:59:16 PM)

```
Server started...http://localhost:9999/ReverseTextWS
```