Persistence

Saving and retrieving objects to/from XML files

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Persistence
Pays Off

Our **Shop** App

Shop V4.0 - implemented the **CRUD** process

Problem: All entered **data is lost** if we **close our application**

Shop V5.0

use XML to make our **data persistent** beyond the life of our app

Solution: Store our objects from memory to XML **files**.

Shop **V5.0** (using XML)

- For our XML persistence, we will use a component called **XStream**.

- **XStream**
  - is a simple library
    to serialize objects to XML and back again.

  - is called a component
    and we must download the **jar** file
    it is stored in, and incorporate it into our project.

http://x-stream.github.io/index.html

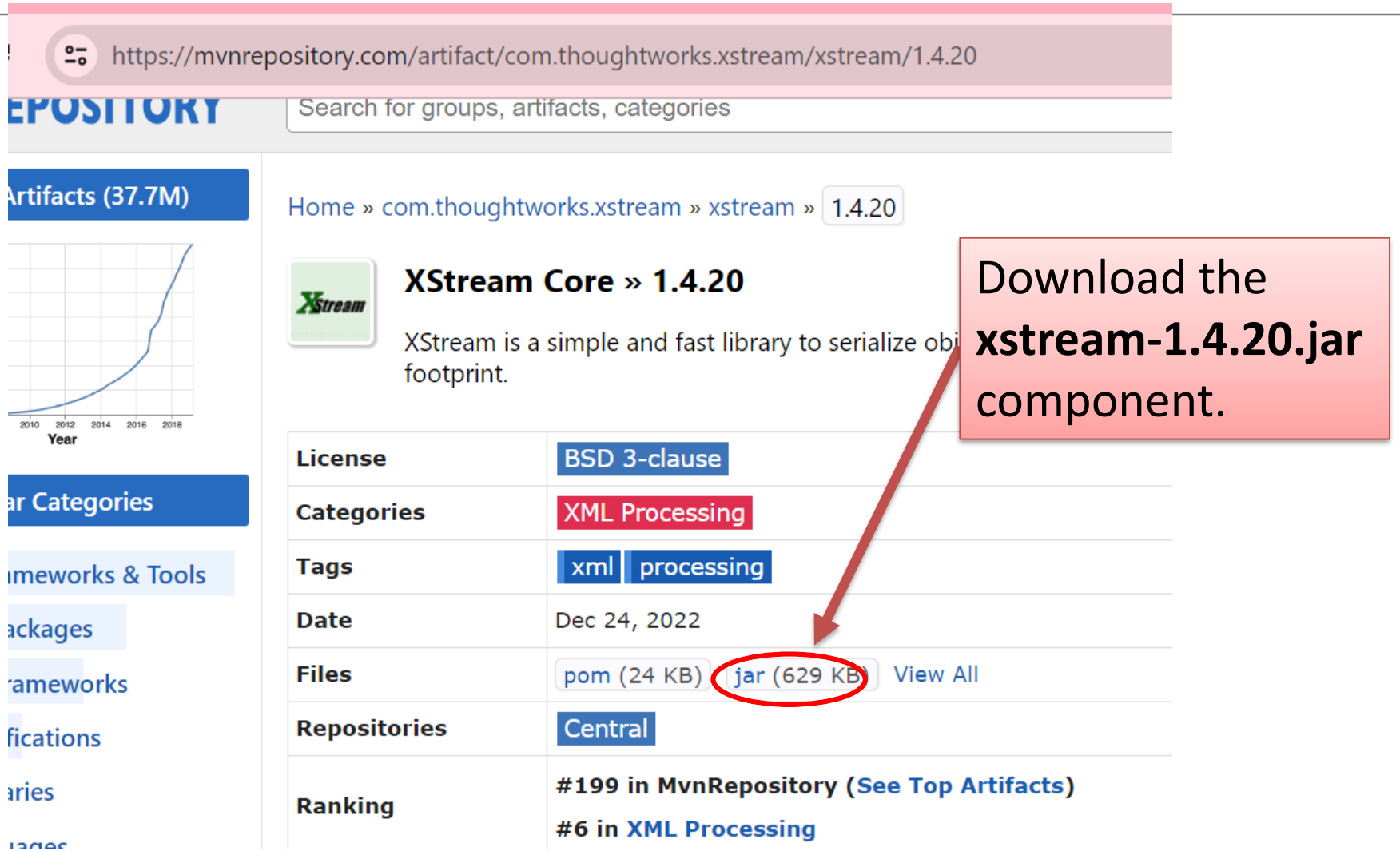
Shop V5.0 (using XML) - **STEPS**

1. Download the **xstream-1.4.20.jar** component
   - Add it to your Shop project.

2. **Store** Class
   - Write the load(), save() methods.

3. **Driver** Class
   - include extra load and save functionality to the menu.

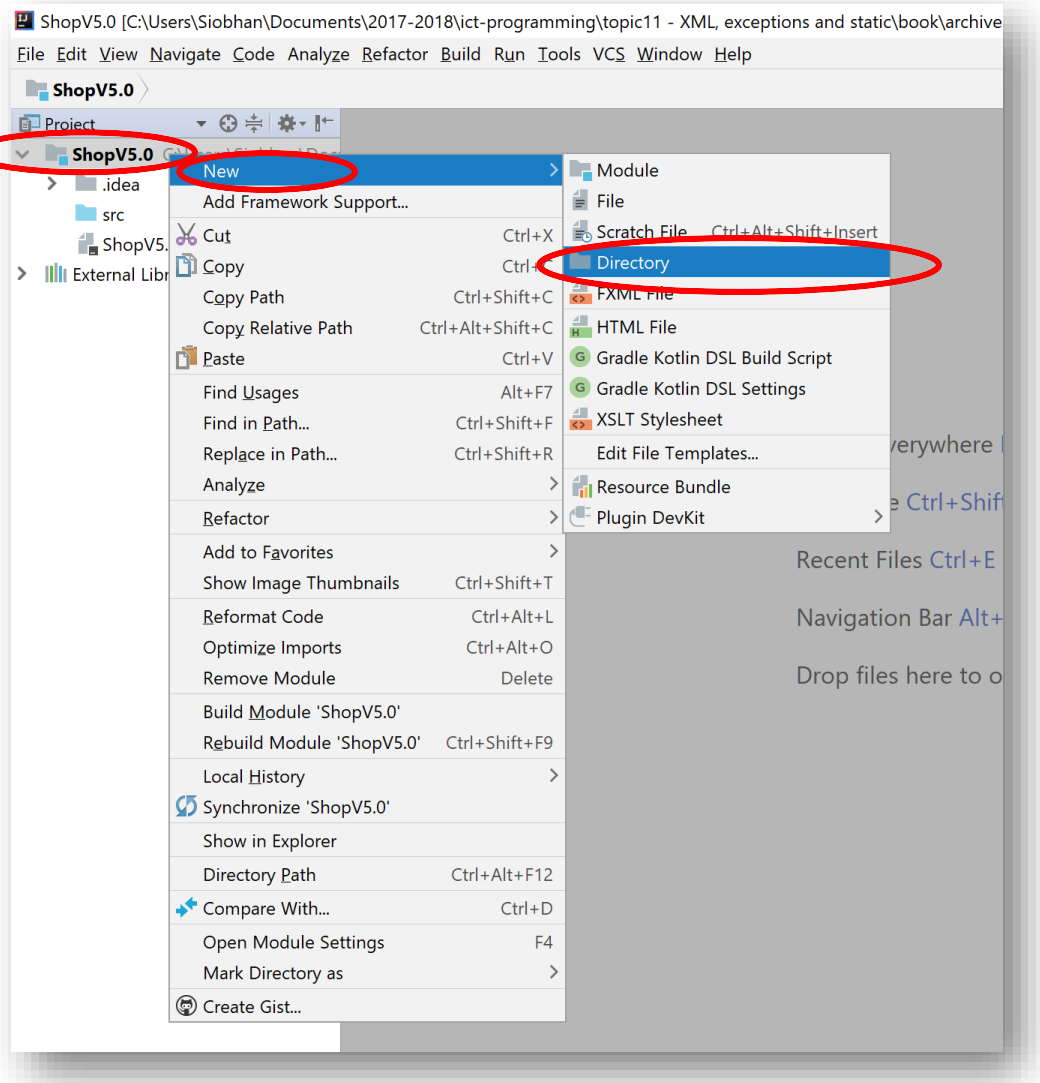
Download the **component**



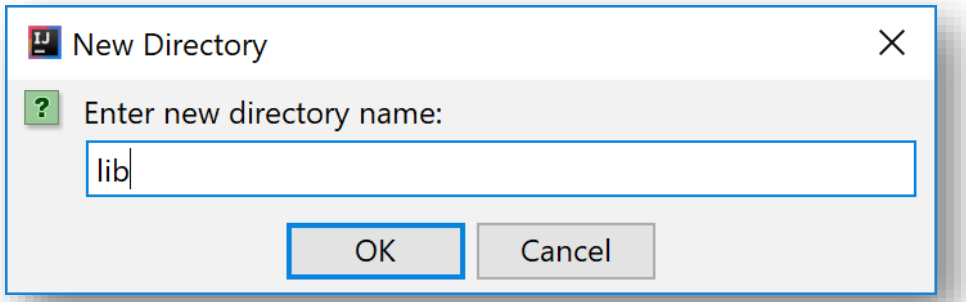
https://mvnrepository.com/artifact/com.thoughtworks.xstream/xstream/1.4.20

Adding a component to the **lib folder** -1

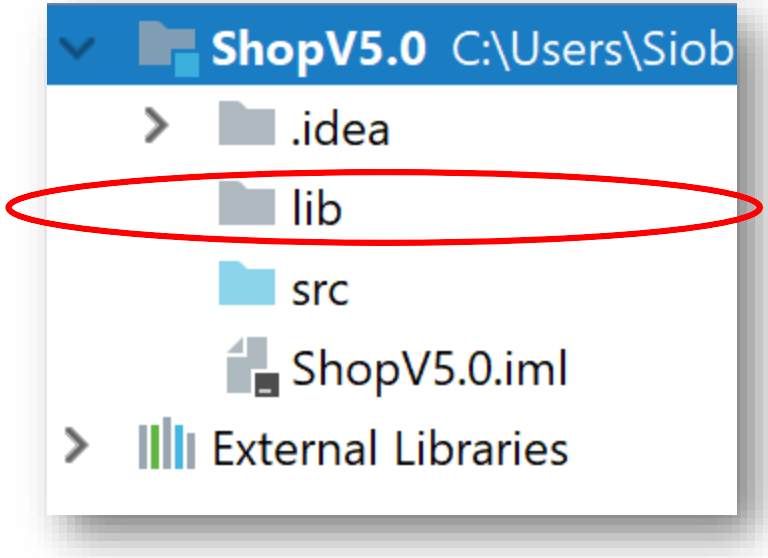
On the ShopV5.0 project…
right click
select “**New**”
then “**Directory**”.



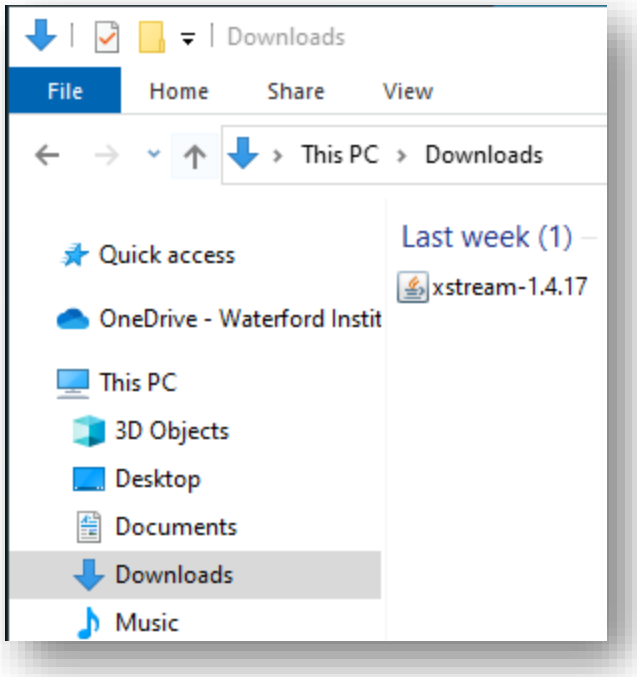
Adding a component to the **lib folder** - 2



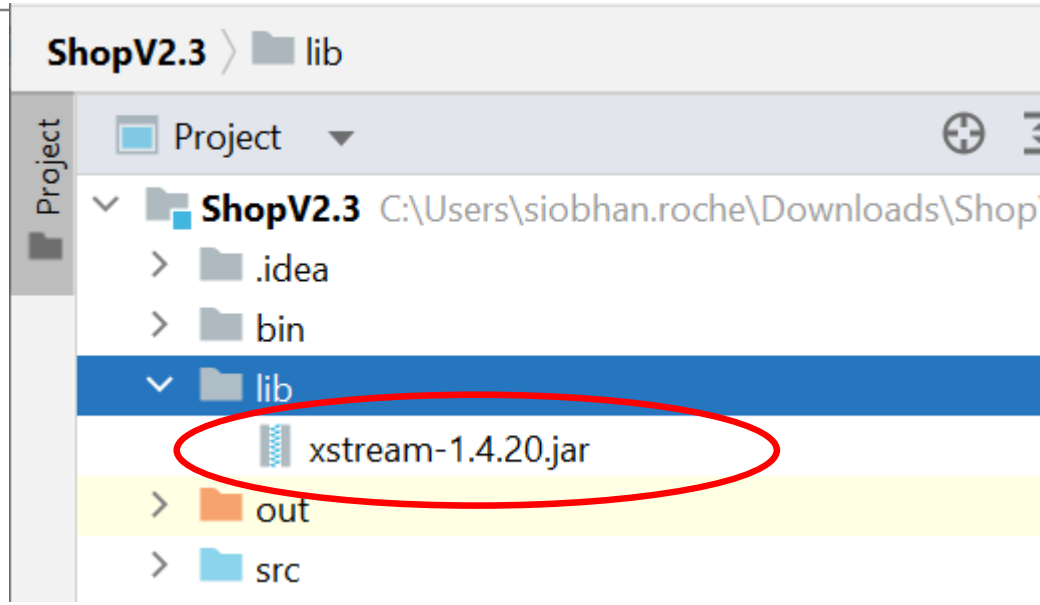
Call the new directory “lib”.



Adding a component to the **lib folder** - 3

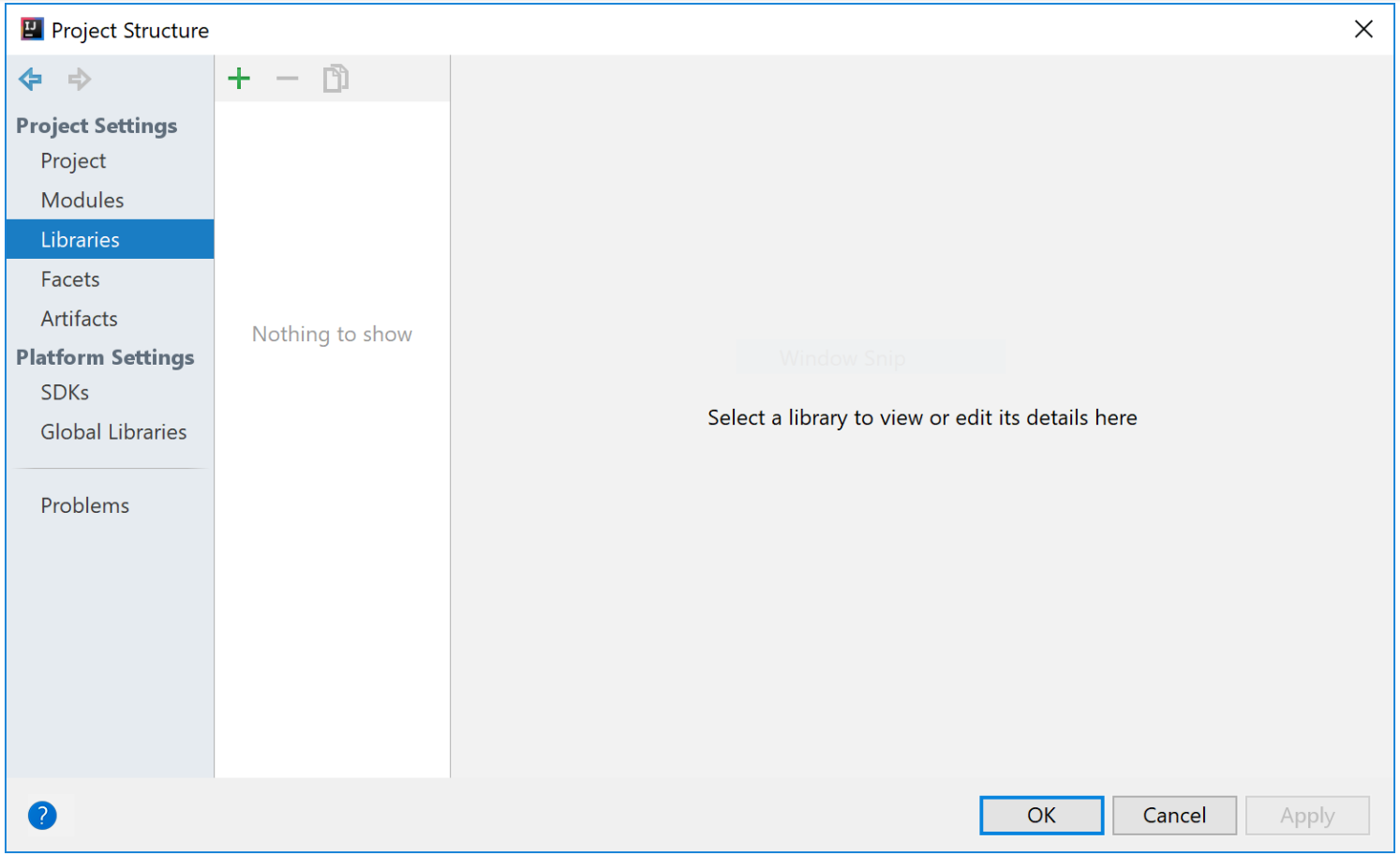


Drag the **xstream-1.4.20.jar** file into the lib folder.



Adding the component to your **build path** - 1

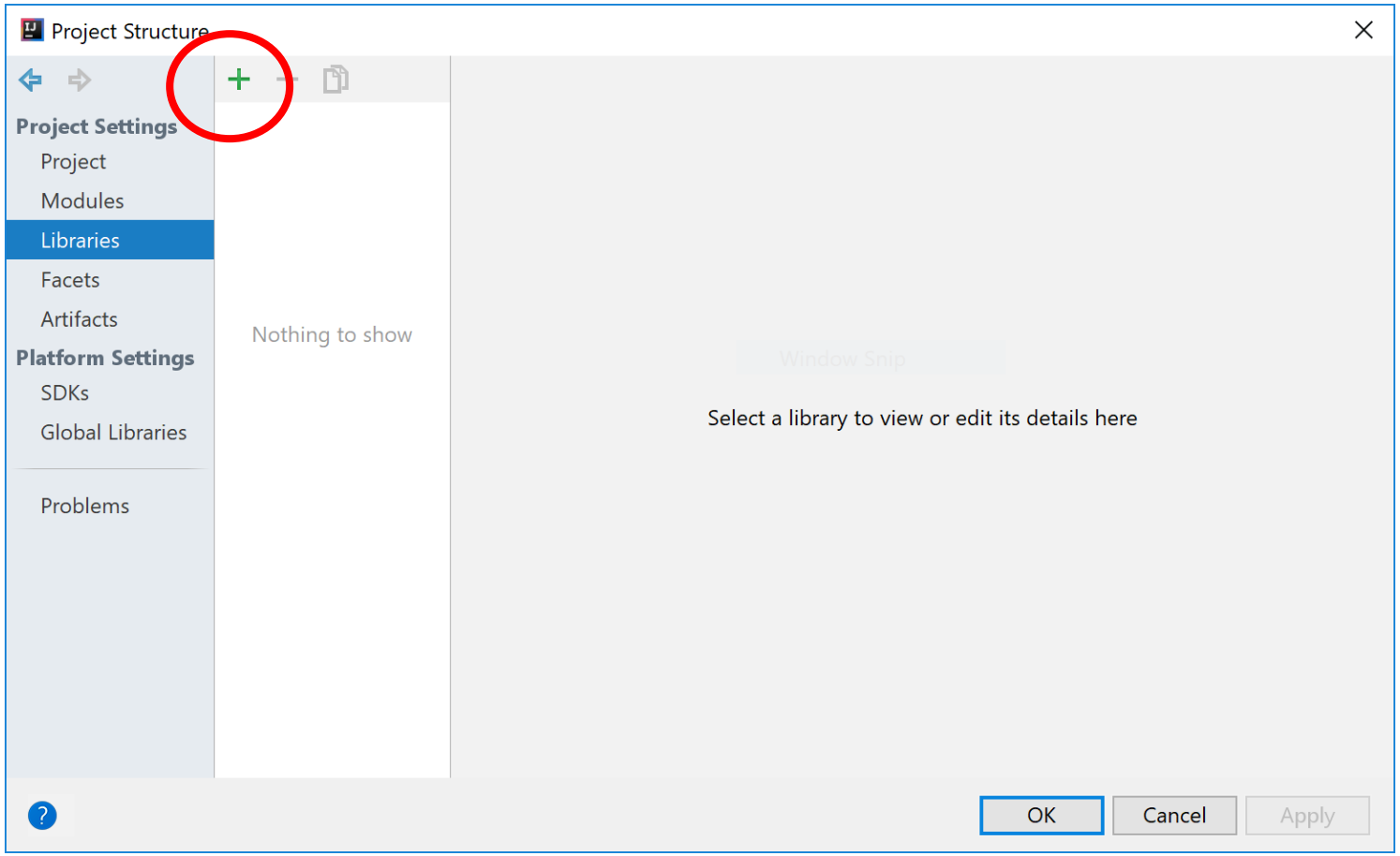
From **File** menu, select **Project Structure.** Click on **Libraries**.



Adding the component to your **build path** - 2

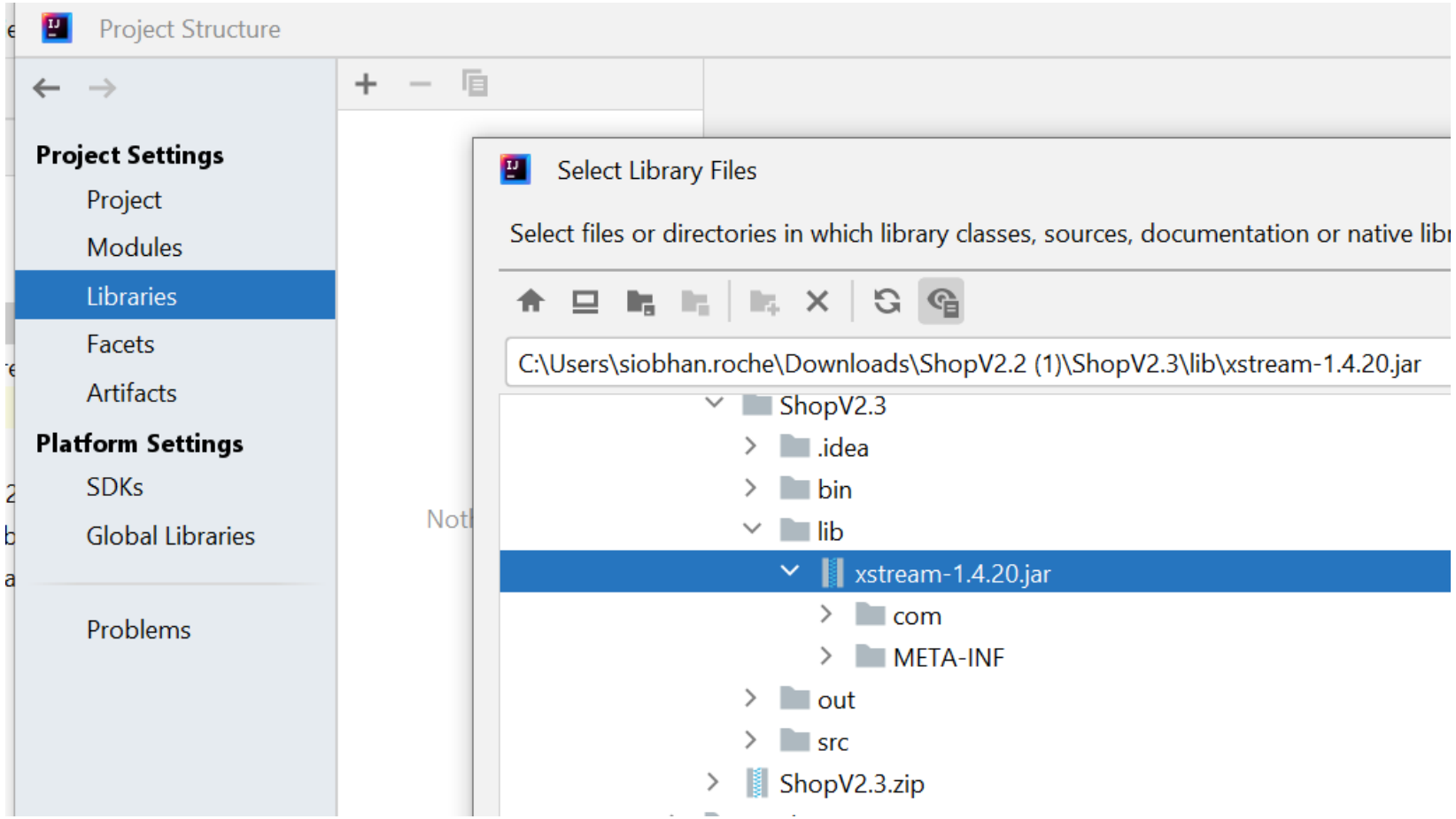
To add a library to your build path:

click on the **+**



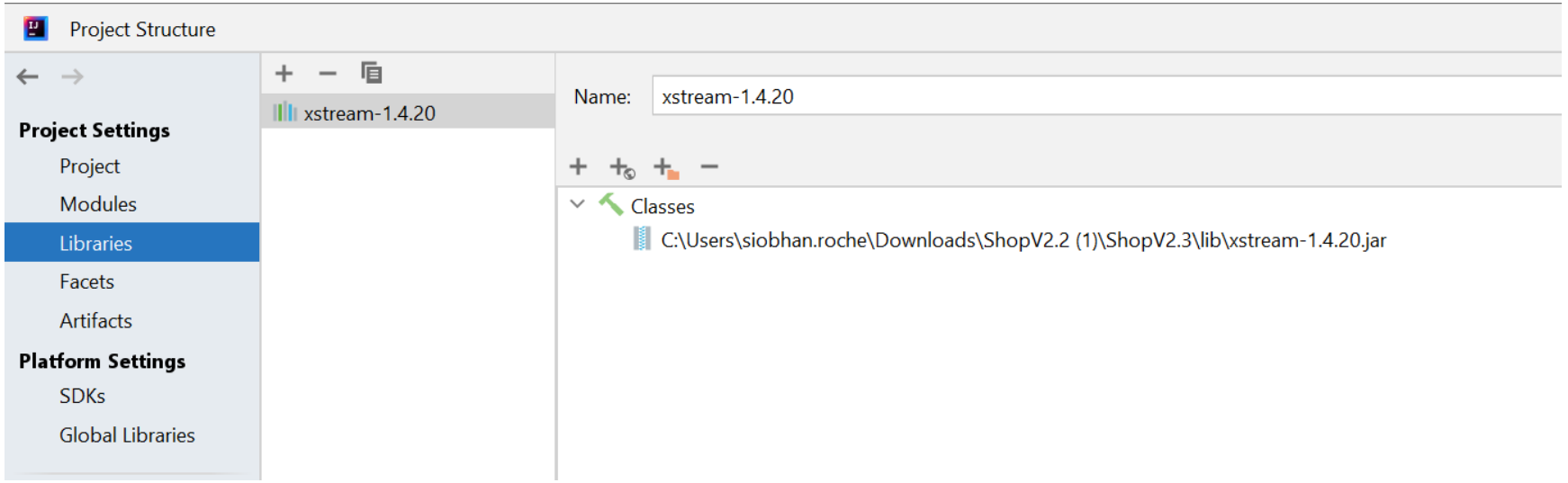
Adding the component to your **build path** - 3

Select **Java** and locate your library…click **OK** (a few times!)



Adding the component to your **build path** - 4

XStream is now added as a library – this means the compiler can find it!

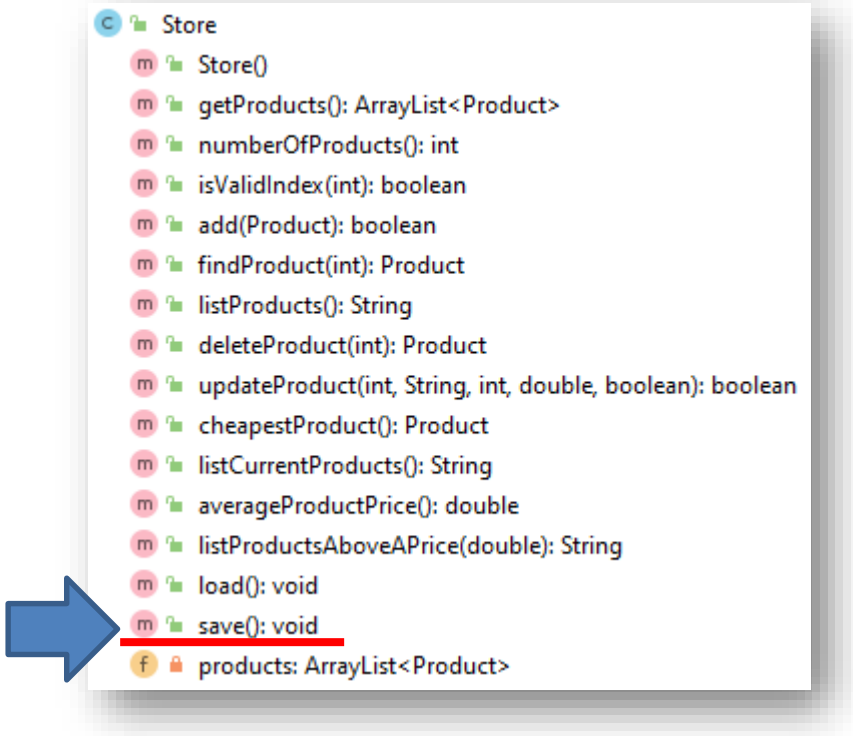


Shop V5.0 (using XML) - **STEPS**

1. Download the **xstream-1.4.17.jar** component
   - Add it to your Shop project.

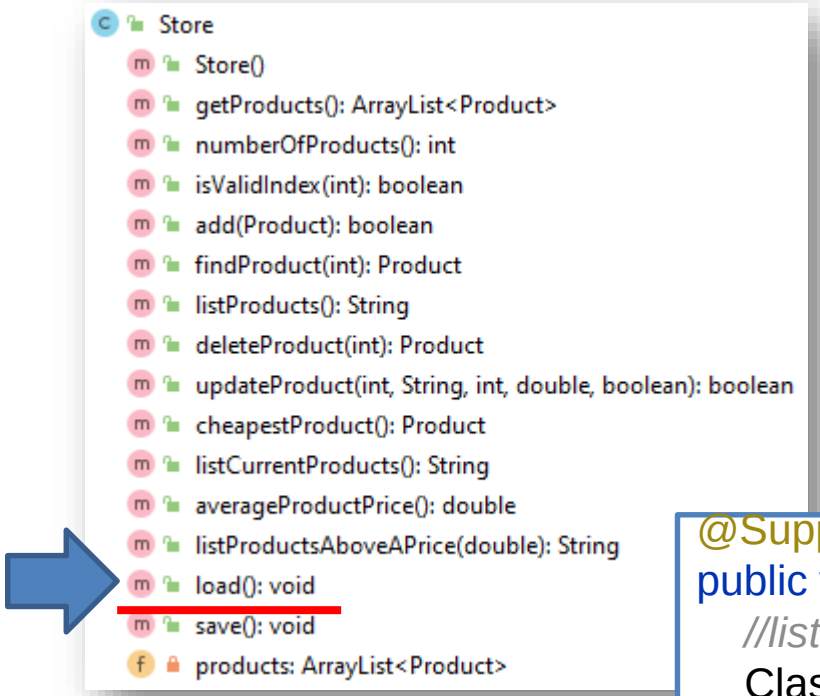
2. **Store** Class
   - Write the load(), save() methods.

3. **Driver** Class
   - include extra load and save functionality to the menu.




```
// 1. Initialize an XStream object variable
// 2. Use it to initialize an ObjectOutputStream to a specific file
// 3. Write out the objects you want saved e.g. products
// 4. Close the stream / file
```

```
public void save() throws Exception
{
    XStream xstream = new XStream(new DomDriver());    //1
    ObjectOutputStream out =
                        xstream.createObjectOutputStream(new FileWriter("products.xml"));    //2
    out.writeObject(products);    //3
    out.close();      //4
}
```

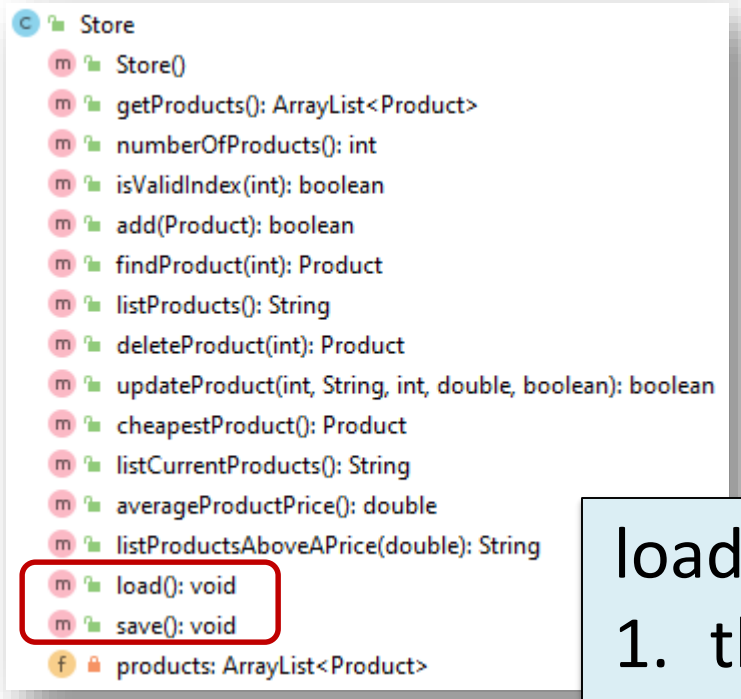


// 1. Provide a list of classes that you want to serialise
// 2. Initialise an XStream object and set up security rules
// 3. Use XStream object to initialize an Object**Input**Stream from a specific file
// 4. Call the is.readObject() method to assign values to the object e.g. products
// 5. Close the stream / file

```
@SuppressWarnings("unchecked")
public void load() throws Exception {
    //list of classes that you wish to include in the serialisation, separated by a comma
    Class<?>[] classes = new Class[] { Product.class };     //1

    //setting up the xstream object with default security and the above classes
    XStream xstream = new XStream(new DomDriver());
    XStream.setupDefaultSecurity(xstream);                  //2
    xstream.allowTypes(classes);

    //doing the actual serialisation to an XML file
    ObjectInputStream is = xstream.createObjectInputStream(new
FileReader("products.xml"));   //3
    products = (ArrayList<Product>) is.readObject();   //4
    is.close();    //5
}
```



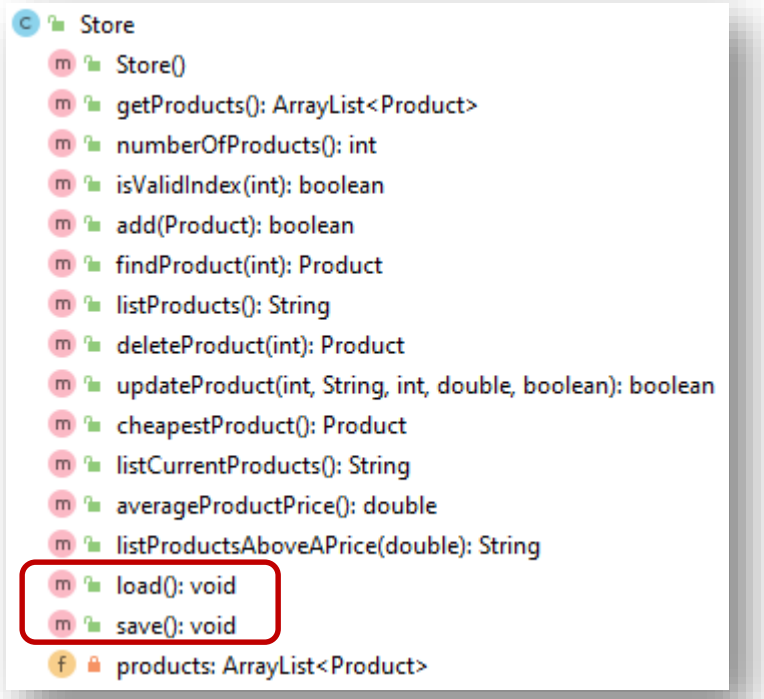
To use the **load()** & **save()** code in another project, change:

load()

1. the class **type** in the list of classes to serialise.
2. the **name** of the xml file.
3. the **type** of object stored in the ArrayList.
4. the **name** of the ArrayList object.

save()

1. the **name** of the xml file.
2. the **name** of the ArrayList object.



Required Packages

```
import com.thoughtworks.xstream.XStream;
import com.thoughtworks.xstream.io.xml.DomDriver;

import java.io.FileReader;
import java.io.FileWriter;
import java.io.ObjectInputStream;
import java.io.ObjectOutputStream;
```

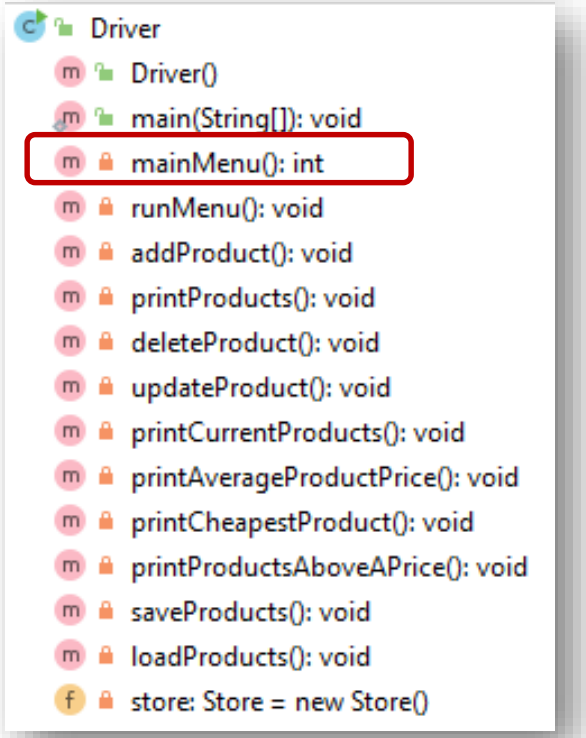
Note: you need to import these additional **packages**.

Shop V5.0 (using XML) - **STEPS**

1. Download the **xstream-1.4.17.jar** component
   - Add it to your Shop project.

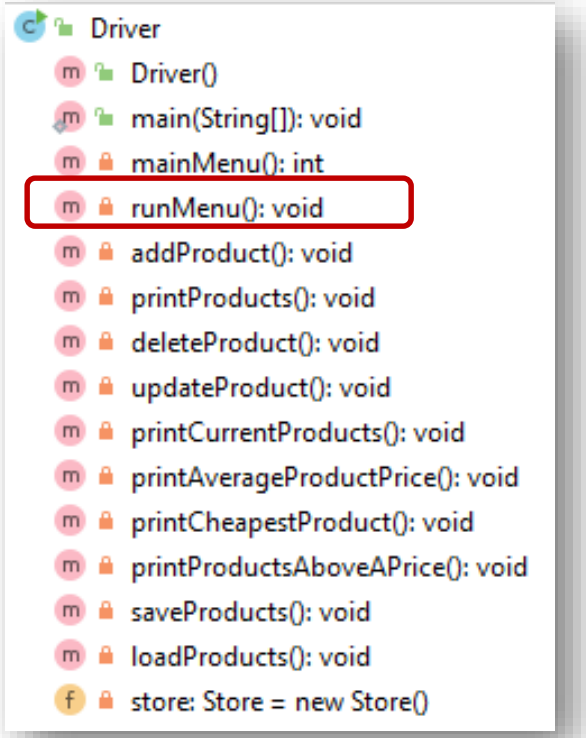
2. **Store** Class
   - Write the load(), save() methods.

3. **Driver** Class
   - include extra load and save functionality to the menu.



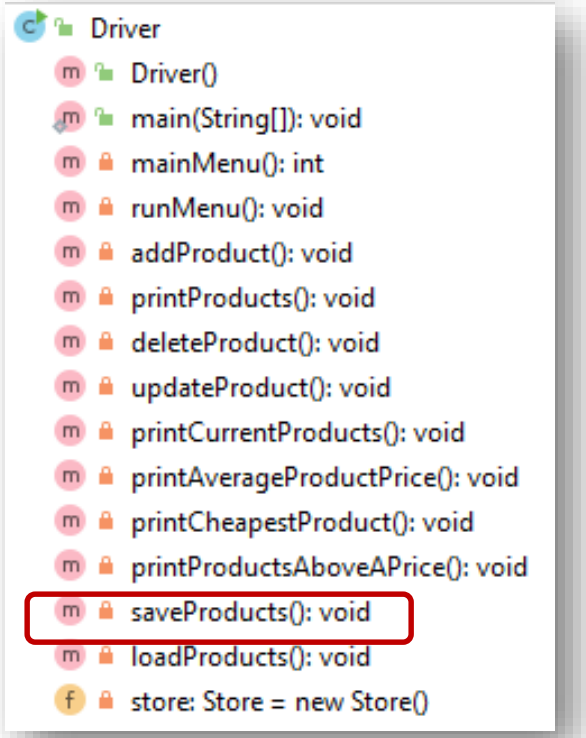
Adding **Save** and **Load** functionality to the **menu**.

```
private int mainMenu() {
    return ScannerInput.readNextInt( prompt: """
            ---------------------------------------------------------------
            |                            Shop Menu                        |
            ---------------------------------------------------------------
            |   1) Add a product                                          |
            |   2) List the Products                                      |
            |   3) Update a product                                       |
            |   4) Delete a product                                       |
            ---------------------------------------------------------------
            |   5) List the current products                              |
            |   6) Display average product unit cost                      |
            |   7) Display cheapest product                               |
            |   8) List products that are more expensive than a given price  |
            ---------------------------------------------------------------
            |   9)  Save products to products.xml                         |
            |   10) Load products from products.xml                       |
            |   0)  Exit                                                  |
            ---------------------------------------------------------------
            ==>>  """);
}
```



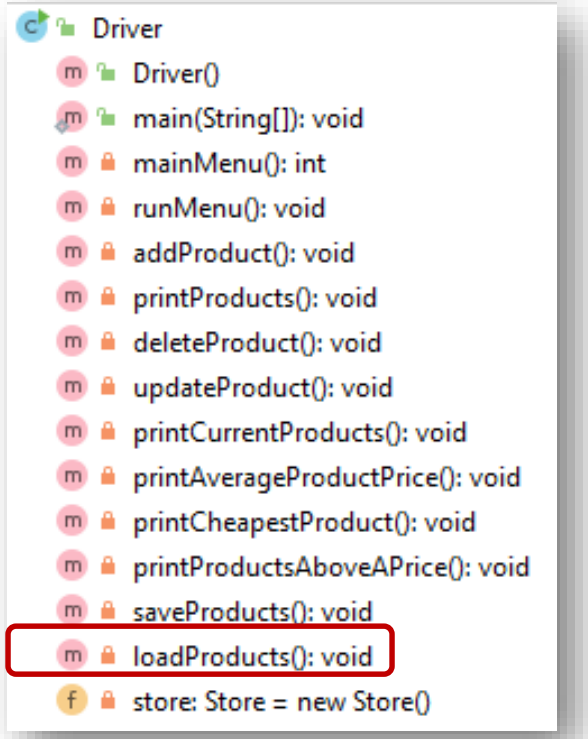
Adding **Save** and **Load** functionality to the **menu**.

```
switch (option) {
    case 1 -> addProduct();
    case 2 -> printProducts();
    case 3 -> updateProduct();
    case 4 -> deleteProduct();
    case 5 -> printCurrentProducts();
    case 6 -> printAverageProductPrice();
    case 7 -> printCheapestProduct();
    case 8 -> printProductsAboveAPrice();
    case 9 -> saveProducts();
    case 10 -> loadProducts();
    default -> System.out.println("Invalid option entered: " + option);
}
```



Adding **Save** and **Load** functionality to the **menu**.

```
//save all the products in the store to a file on the hard disk
private void saveProducts() {
    try {
        store.save();
    } catch (Exception e) {
        System.err.println("Error writing to file: " + e);
    }
}
```



Adding **Save** and **Load** functionality to the **menu**.

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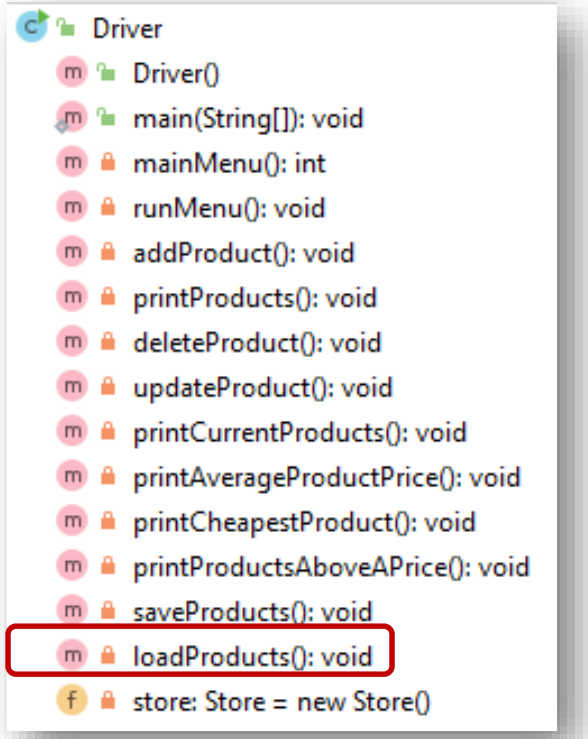
//save all the products in the store to a file on the hard disk
private void saveProducts() {
    try {
        store.save();
    } catch (Exception e) {
        System.err.println("Error writing to file: " + e);
    }
}
```

```
//load all the products into the store from a file on the hard disk
private void loadProducts() {
    try {
        store.load();
    } catch (Exception e) {
        System.err.println("Error reading from file: " + e);
    }
}
```



try/catch

The save() and load() methods in the Store class can throw an Exception. So, if we want to use, say, the load(), method, we need to write code to "handle" an Exception being thrown. This is where try/catch comes in and we will look at this construct in the next slide deck.

```
//load all the products into the store from a file on the hard disk
private void loadProducts() {
    try {
        store.load();
    } catch (Exception e) {
        System.err.println("Error reading from file: " + e);
    }
}
```

products.xml

```
<object-stream>
  <list>
    <Product>
      <productName>24 inch monitor</productName>
      <productCode>3423</productCode>
      <unitCost>129.99</unitCost>
      <inCurrentProductLine>true</inCurrentProductLine>
    </Product>
    <Product>
      <productName>14 inch monitor</productName>
      <productCode>23321</productCode>
      <unitCost>109.99</unitCost>
      <inCurrentProductLine>true</inCurrentProductLine>
    </Product>
  </list>
</object-stream>
```

When the **save** option is selected from the menu, this **XML file** is created

The XML file is located in your **root project directory**.

Self Study Questions

1. What is persistence?

2. What file type do we store Java objects in?

3. Which Java component did we use for serializing objects?

4. What 2 methods do we have to write to use this component?

Any Questions?