PROJECT Design Documentation

Team Information

- Team name: b-fishes
- Team members
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Executive Summary

Our rare fish e-store is a cutting-edge platform designed to provide customers with an easy-to-use and secure online shopping experience. The website is built using a single-page application (SPA) architecture, utilizing the Angular framework for the front-end and Java Springboot for the back-end. This technology combination enables us to provide a fast, responsive and dynamic user interface.

The website allows users to create an account and log in. Once logged in, users can browse our extensive selection of rare fish, view detailed product information, and add their desired fish to their shopping cart. The shopping cart is designed to be user-friendly, allowing users to easily edit and update their orders before checkout.

The website also features an admin login, providing the administrators with a secure back-end portal to manage product information, customer data, and order fulfillment. Administrators can add, edit, and remove products, view and manage customer data, and process orders, ensuring the website's operations run smoothly.

In conclusion, our rare fish e-store offers customers an exciting and hassle-free shopping experience. With our extensive selection of rare fish, user-friendly shopping cart, we are confident that our customers will enjoy shopping with us.

Purpose

> The purpose of this project is to allow customers to purchase their favorite exotic fish, all while our product owner gets to make some profit while providing a needed service.

Glossary and Acronyms

> *Provide a table of terms and acronyms.*

Term	Definition
SPA	Single Page

Requirements

> The store owner should have complete control of the displayed inventory. This includes updating, adding, and deleting items from the inventory.

> The users of the store should be displayed the inventory on a home page. From this homepage the users should be able to view individual items in the store with greater detail (reviews, extra info, etc.). The user also have the ability to log in with a unique username and password

> Once at the detailed item page, the user should have a functional shopping cart. Where they can add, delete items from their cart. The cart is persistant and will remain with the user throughout multiple sessions.

> When a user clicks the cart icon, they will see the items in their cart, and they will be given the option to checkout.

Definition of MVP

> Fully functional e-store application as mentioned in the section above. A reward points system made for users. A review system below each item detail page

MVP Features

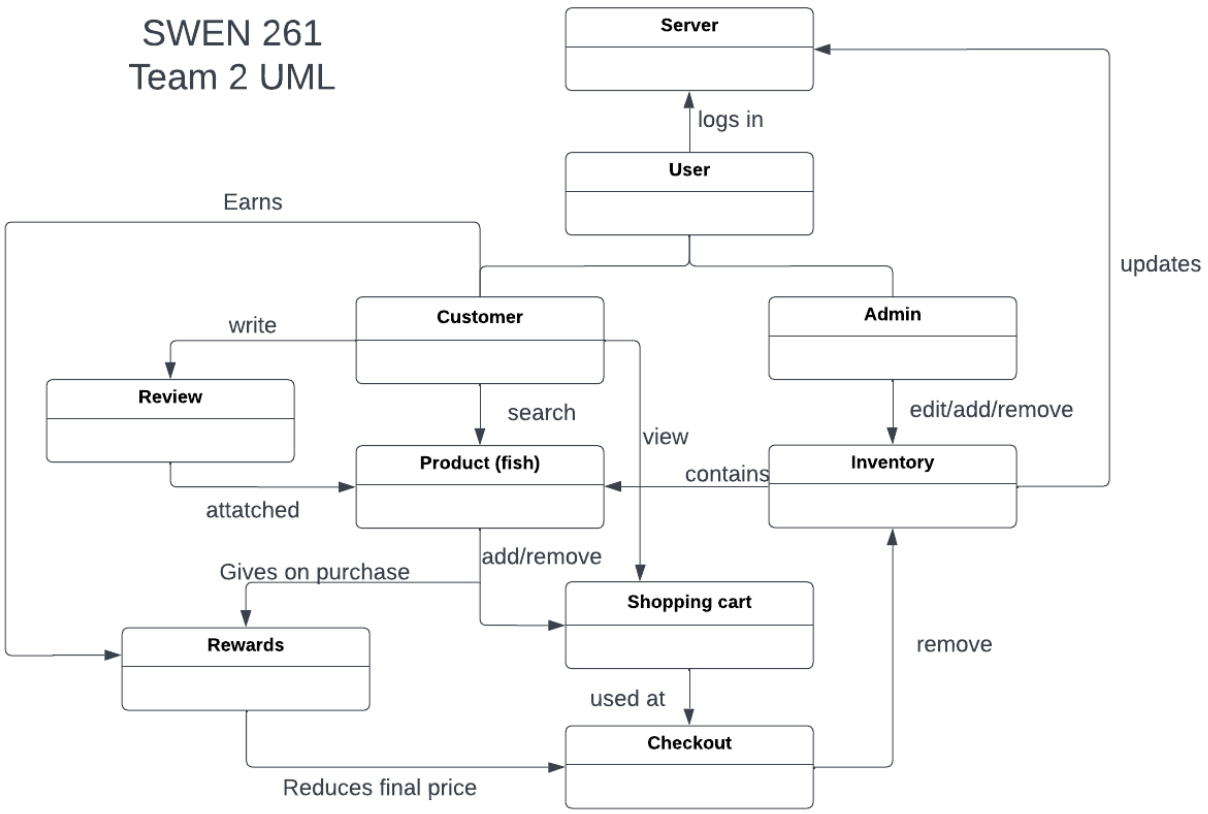
> Each fish bought from our store = 1 point Upon a user having more than 10 points, they can receive 1 item for free. Every user has the ability to leave a review under each item, and update it as they see fit.

Roadmap of Enhancements

> Only allow users who purchase the item to review it Allow reviews to contain more than just an integer 1-5. Contain a long string for the review.

Application Domain

This section describes the application domain.



> *Provide a high-level overview of the domain for this application. You can discuss the more important domain entities and their relationship to each other.*

Architecture and Design

This section describes the application architecture.

Summary of Object Oriented Design Principles

Here we have outlined 4 Object-Oriented principles we utilized in the creation of this project, and how those principles directly apply to our code

I: Single Responsibility: Per wikipedia, "A module should be responsible to one, and only one, actor." Single Responsibility dictates that a program should have all of its modules (classes in Java) perform a single purpose; therefore, a program should be made up of many specialized modules rather than a single, omnipotent one. This preference towards simplicity helps prevent programs from becoming chaotic systems where a single error thrown can cause the whole code to crash, rather than be dealt with on a case-to- case basis. For example, we used this principle in our "cart- component" class in our angular code. The cart component module is exclusively responsible for showing the user's cart and storing the methods needed to operate it; any other functionality is stored elsewhere in the code.

II: Information Expert: Similar to Single Responsibility, Information Expert dictates that all responsibilities regarding a certain function should be delegated to the class which holds the most information about that function. For example, you wouldn't ask a physicist to how to compose a symphony and you wouldn't ask a pianist how to build a rocket. This helps the program avoid redundancy in class communication as well as make it easier for humans to trace back through the code. We utilize this principle in our UserController class, for example. The User's cart is stored as a field in the User class, and therefore the methods associated with

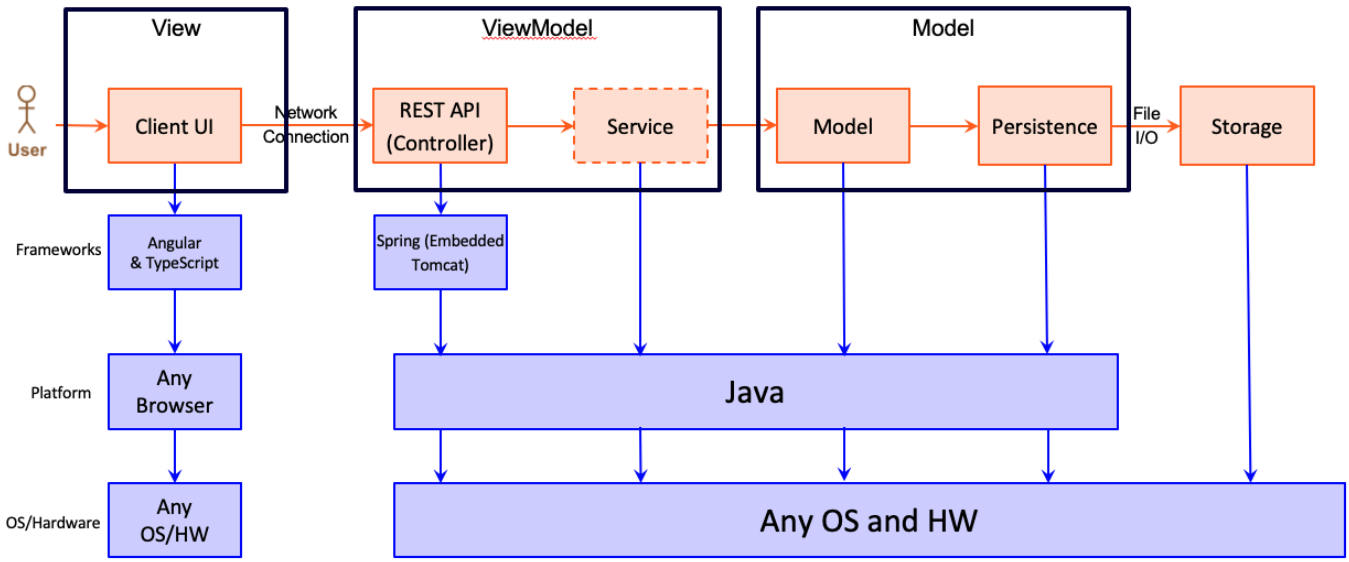
interacting with the cart are stored in the UserController as that is the class that has the most information on the User and its cart.

III: Low Coupling: Low Coupling is demonstrated in our code design by ensuring minimally-required inheritance or imports between classes. All of our Model, Controller, and Persistence program files only interact with each other when required, and all of these interactions occur directly. The Model Package is the lowest level of abstraction, where the Product.java file does not import any other custom classes. In the Controller package, the ProductController file imports functions from the Model to create Product objects, and the ProductDAO interface to manipulate the JSON file information. In the Persistence package, the ProductDAO interface only imports the Model, and the ProductFileDAO imports the Model and implements the ProductDAO interface. This creates a very linear, direct system of inheritance between our Java classes. In order to maintain or improve this concept's presence in our code, we should ensure that functions or code sections added in the future should not require unnecessary additional imports. If further communication between the Java classes are needed, mirrored functions should be added across the classes to maintain this inheritance structure. Another example of Abstraction and Low Coupling is the fact that the reviews are stored using usernames (rather than User objects) in the map. By holding only relevant data as opposed to an object itself, the system prevents itself from being reliant on the User.java interface.

IV: Controller: In our project, we utilize a Controller java class, ProductController, to initially handle curl commands from the terminal. Later on in the project development, this class will directly handle user requests from the Angular UI. When the user commits any action, whether through the UI or the terminal, the ProductController class is the first Java class to process it. Based on the given command, it then calls functions from the Persistence package to actually collect or modify data. In order to maintain or improve this concept's presence in our code, we should properly implement the Angular UI and ensure that user requests are still sent to the Controller directly. For the rest of the project, we should also ensure that no other custom Java class comes between reading input from the user, and the controller package.

Summary

The following Tiers/Layers model shows a high-level view of the webapp's architecture.



The e-store web application, is built using the Model–View–ViewModel (MVVM) architecture pattern.

The Model stores the application data objects including any functionality to provide persistance.

The View is the client-side SPA built with Angular utilizing HTML, CSS and TypeScript. The ViewModel provides RESTful APIs to the client (View) as well as any logic required to manipulate the data objects from the Model.

Both the ViewModel and Model are built using Java and Spring Framework. Details of the components within these tiers are supplied below.

Overview of User Interface

> The user iterface contains 5 pages.

> The home page contains a login button, the inventory.

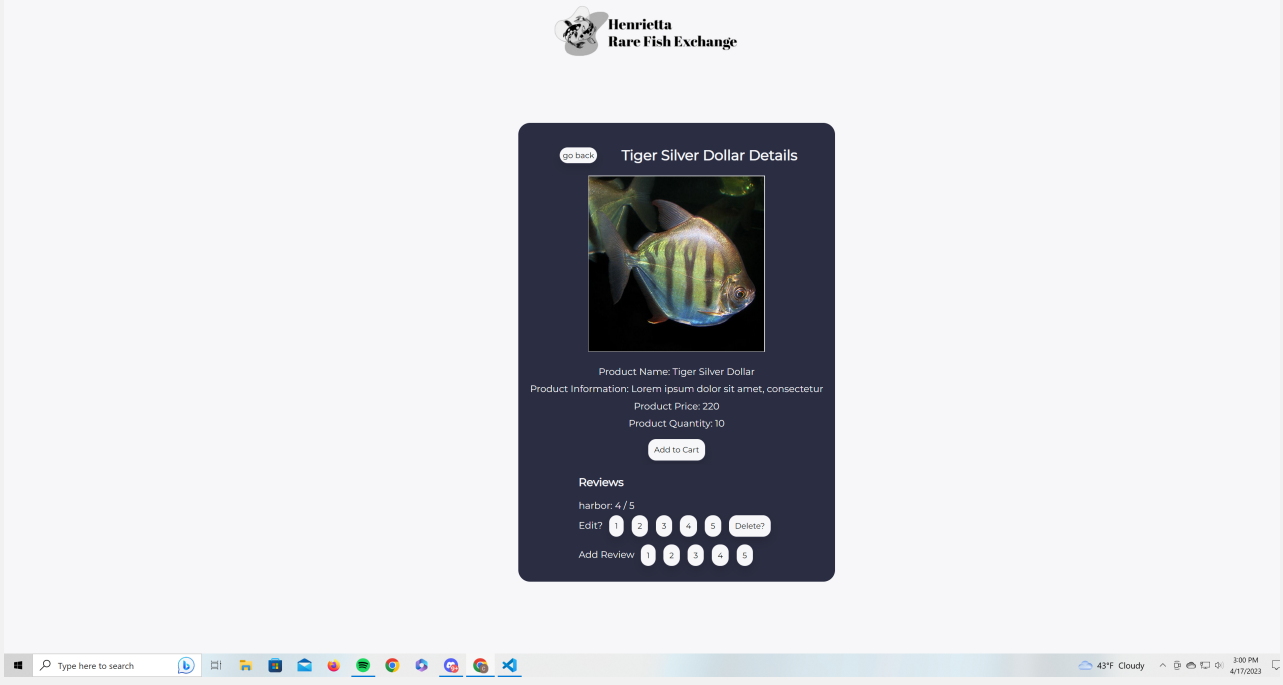
> The item detail page contains the item, user reviews, and a 'add to cart' button

> The cart page contains the items that the user has added to the cart, the rewards points the user has and a 'checkout' button.

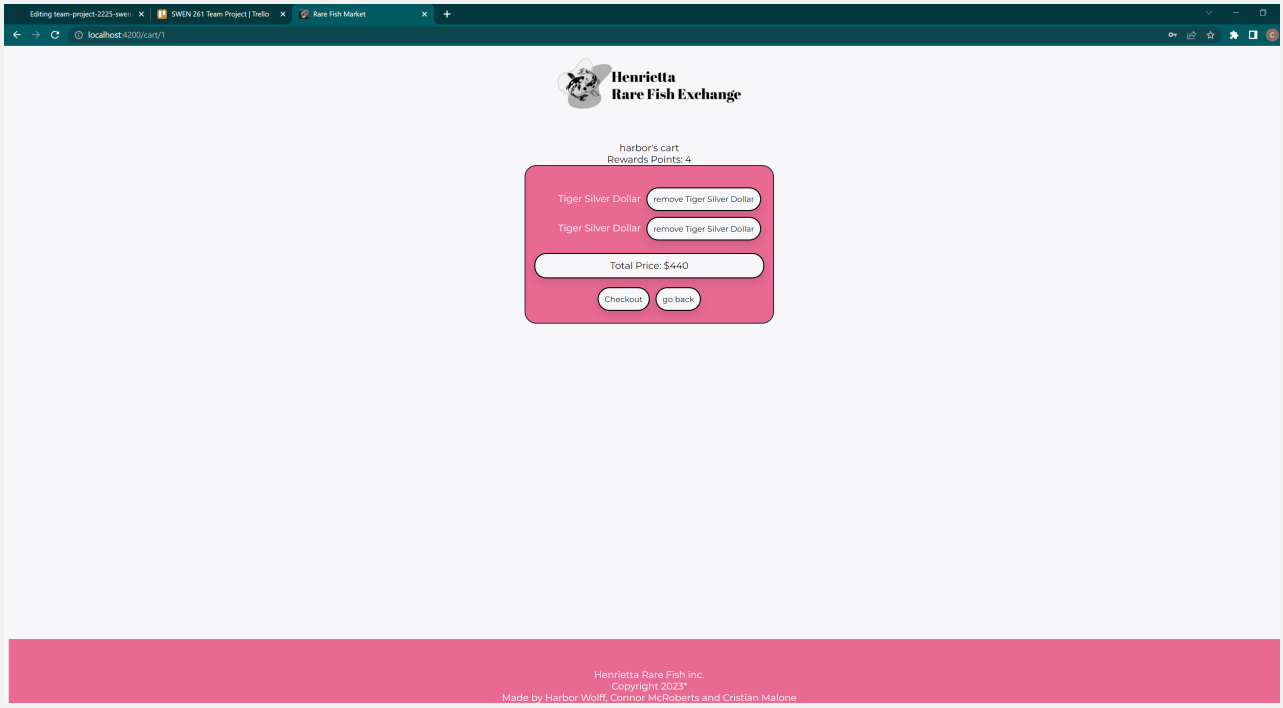
> The login pager and the create account pages both contain fields for the users to enter in information. Such as username and password.

Note for the admin these pages may look different.

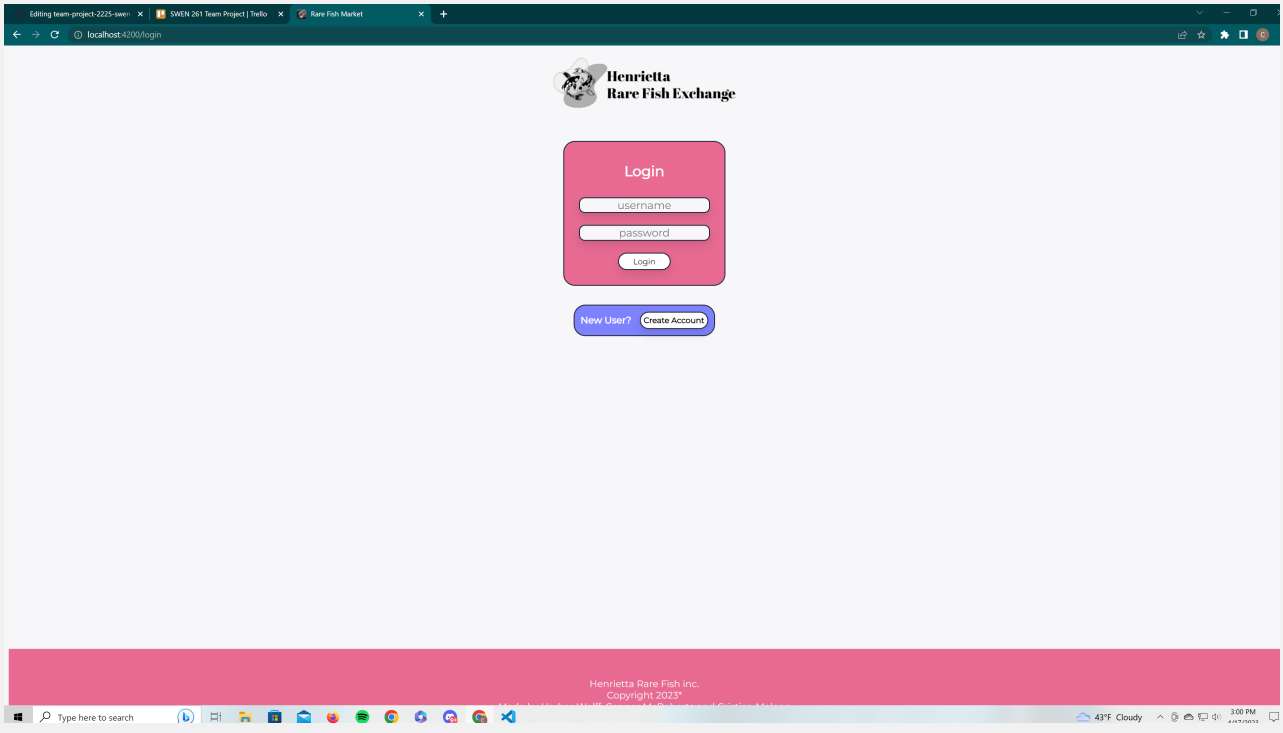
> Item Detail page

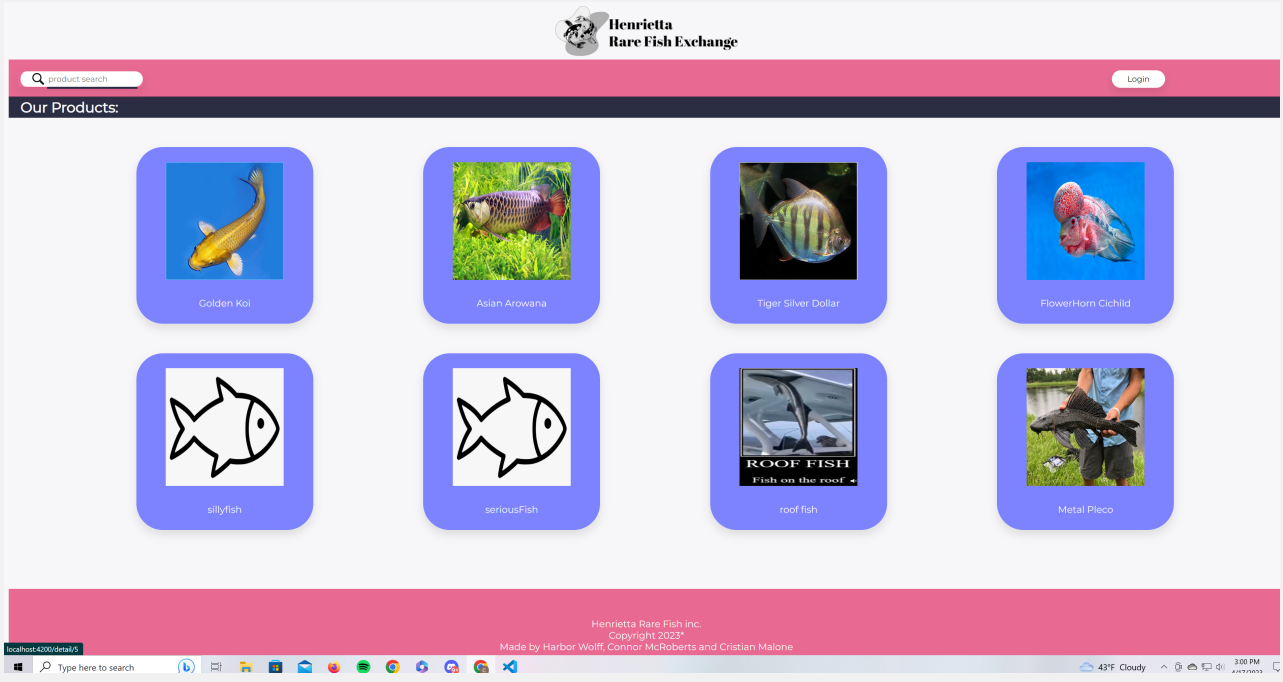


Checkout page



Login page



> Inventory page
>
> 
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View Tier

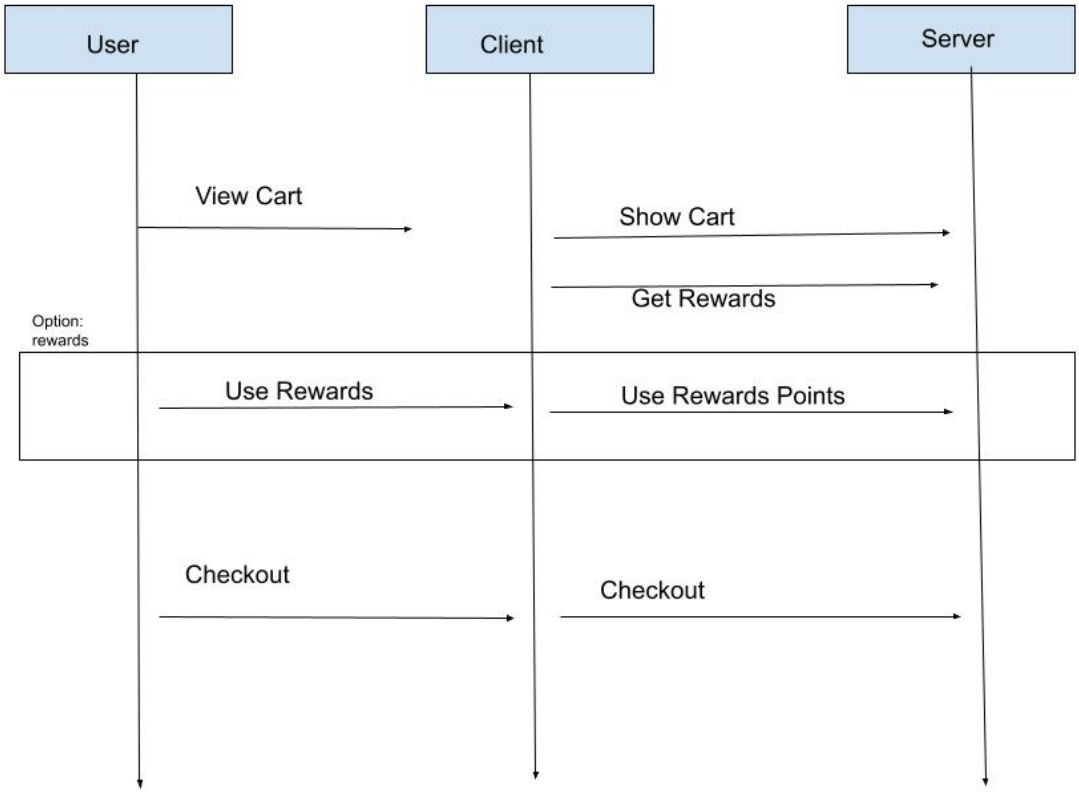
> Our view tier follows a SPA architecture, using the best pratices perscribed by angular.

> For example we use app-routing to choose what components to display

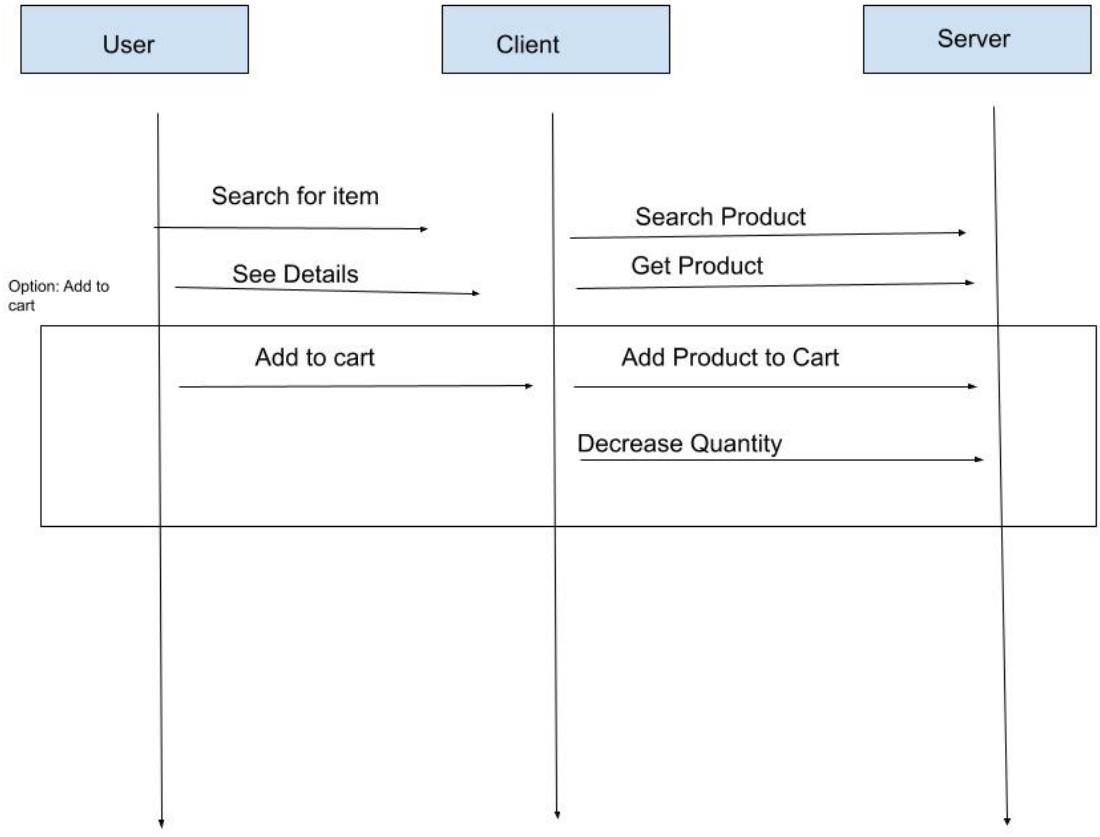
> We store all 'logic' functions, and anything that deals with the api in services (see: product.service, login.service)

> Components store the data that they display, and call upon services for any data that needs external tools.

Checking out



Searching for an item

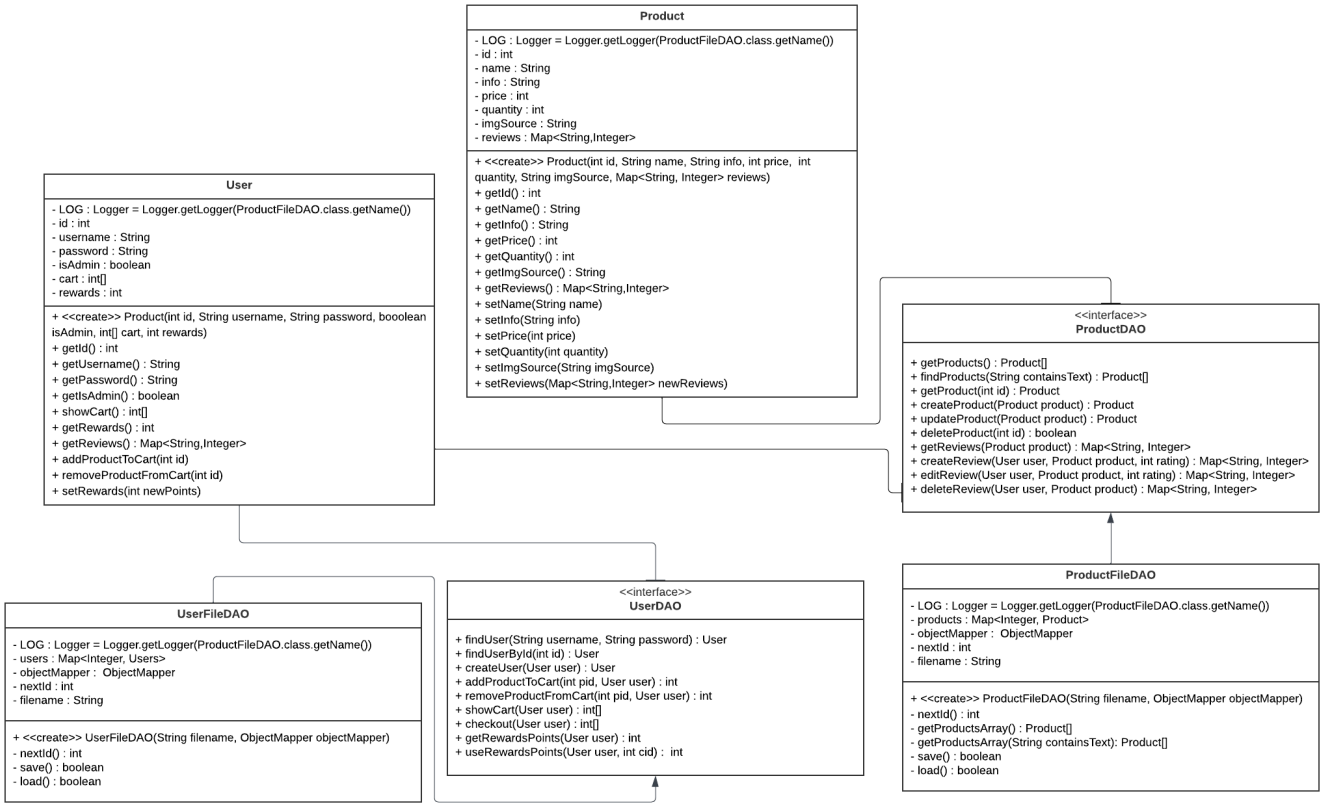


ViewModel Tier

Our ViewModel Tier consists of four files, two in the API and two in the Angular UI. In the API, the ProductController.Java and UserController.Java files consist of functions that correspond to every possible user interaction. When an interaction occurs, a function in the controller first checks to see if that interaction was valid. If so, the function will call the corresponding function in the persistance files to actually modify or retireve data, and return an HTTPStatus of OK. Otherwise, the function will return an HTTPStatus that corresponds to that specifc error with the request and notify the user of it.

In the UI, the ProductService and LoginService are responsibel for connecting the API to the user interface. When users interact with the website through the UI, each service contains the URI to Controller mappings, and use them to call the specific HTTP controller functions that correspond the user's action. This way, both the website UI and JSON information will update at the same time.

Model Tier



This tier of the design contains six Java files on the API side of the program's operation. Two files in the Model Tier, Product.Java and User.Java, directly retrieve and manipulate data from Product and User objects. For Product.java, each Product object contains an Integer id, a String name representing its name, a String info representing a description of the product, an Integer price representing its price, an Integer quantity representing the product's quantity, a String imgSource representing a link to the corresponding image for a product to be displayed, and a Map<String,Integer> representing the reviews for that product. The rest of the program is filled with various getters and setters for each attribute. For User.Java, each User object contains an Integer id, a String username representing the user's username, a String password representing the user's password, a Boolean isAdmin to indicate if the user has admin privileges, an Integer array holding the Product ids of products in the user's cart, and an Integer rewards representing the user's current rewards points. Again, the rest of the program is filled with various getters and setters for each attribute.

The other four files deal with persistence. They call functions from the object classes to update the contents of the JSON files, which contain Product and User object information currently avaialble to the user. ProductDAO.java and UserDAO.Java are interfaces, while ProductFileDAO.java and UserFileDAO.Java implement those intefaces to actually modify data. Corresponding functions from the controller files call these functions whenever a user interacts with the website. Each FileDAO contains a String filename referencing the corresponding JSON, and an array of either Product or User Objects representing the local instantiation of the current Products or User. Whenever a function call is made, it updates the locally instantiated array and saves its contents to the corresponding JSON file.

Static Code Analysis/Design Improvements

According to JaCoCo and SonarQube analysis, our code coverage is 97.2%. Given current time constraints, we believe this to be adequate for the current project because most of the uncovered lines of code are either detected branches that will never occur or menial tests that we are absolutely sure work. Every crucial function has been completely or nearly covered in the API with unit tests, and unecessary commented code or unused libraries have been deleted. Obviously, if given more time, we would work towards increasing that coverage all the way to 100%, investigating the causes of coverage failures and working through our technical debt.

One design improvement that we would make to our code base if given more time would be to implement more security and error handling in the API code. In the UI, we prevented elements or buttons from displaying to users in scenarios where errors could occur. For example, A user cannot look at their cart or add items to their cart without being logged in, because user that is not logged in does not have an existing cart, so adding an item to a cart would result in an error. Therefore, the website does not display those options to the user until they are logged in. However, if a user were to somehow bypass these conditional displays, they could cause these errors to occur and there may not be a way to recover from them. Most of the functions in the API have error piping, but some do not. Therefore, if more time was given to increase encryption on accessing website elements and implement more error piping, that would definitely be ideal.

Speaking of preventing errors, another improvement that we would make to our code base if given more time would be to increase the security of the website. With the current file structure and login system, our program would be very susceptible to SQL Injection attacks. A malicious user could easily try to run their own commands when submitting fields for the login, exposing the information of all current users or possibly learning the admin login. Therefore, if given more time, we would definitely have wanted to create a better security to encrypt users' private data and protect against attacks.

A third design improvement that we would like to make to our code base if given more time is to improve UI of the user review system. The button system for creating and editing reviews is very usable and aesthetically pleasing. However, the display of the reviews themselves is relatively bland, displaying only the user's name and their rating as a number out of five. If possible, we would make this display more clear and complimentary to the website's visuals. We could potentially represent the user's reviews as stars or other icons, or even add an option for user's to describe their review in text.

Testing

TESTS WRITTEN: getProduct, createProduct, updateProduct, getProducts, searchProducts, deleteProduct getReview, createReview, editReview, deleteReview findUser, createUser addProductToCart, removeProductFromCart, showCart checkout, getRewardsPoints, useRewardsPoints, notEnoughRewardsPoints

RESULTS: All written tests have passed.

Acceptance Testing

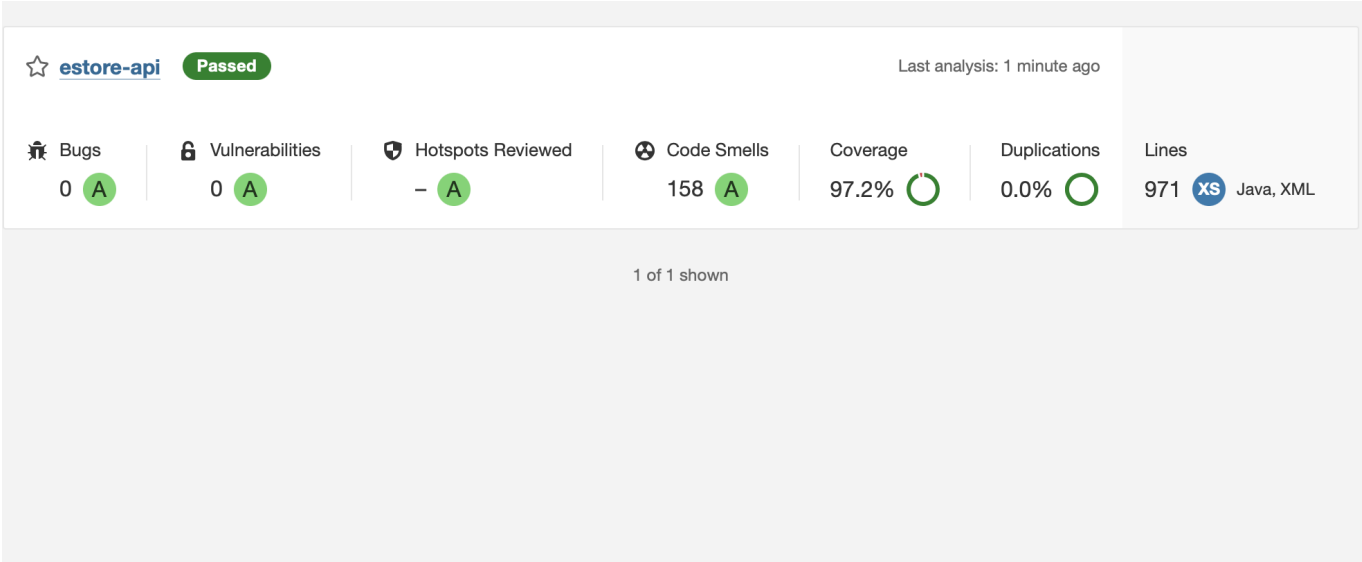
estore-api

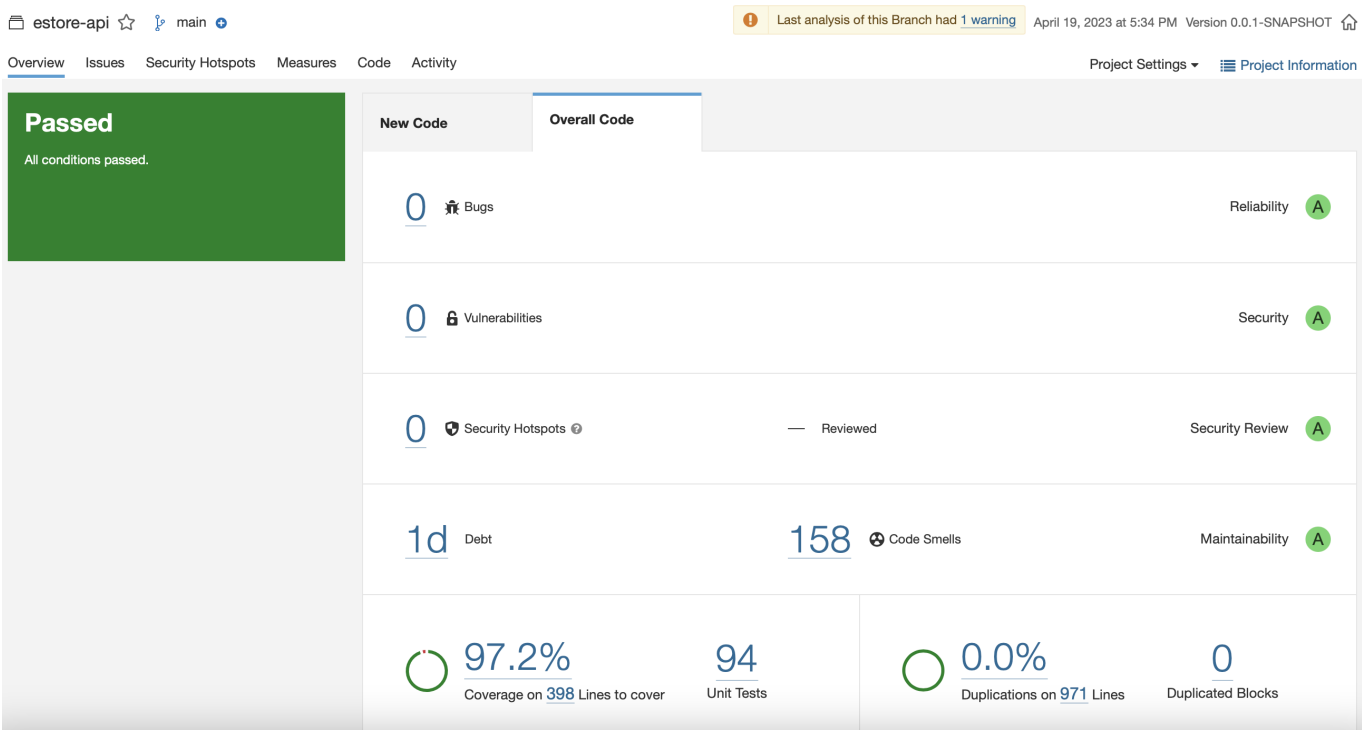
estore-api

Element	Missed Instructions	Cov.	Missed Branches	Cov.	Missed	Cxty	Missed	Lines	Missed	Methods	Missed	Classes
com.estore.api.estoreapi		0%		n/a	4	4	7	7	4	4	2	2
com.estore.api.estoreapi.model		86%		75%	5	29	5	53	4	27	0	2
com.estore.api.estoreapi.controller		100%		100%	0	52	0	195	0	22	0	2
com.estore.api.estoreapi.persistence		100%		97%	1	48	0	143	0	31	0	2
Total	68 of 1,790	96%	2 of 98	97%	10	133	12	398	8	84	2	8

We currently have an average coverage of ~94% with all necessary methods being tested.

Unit Testing and Code Coverage





Our targets for testing are every single API call possible on the backend. This is to ensure that the Client can reliably make HTTP requests during runtime without having to worry about unexpected or improper functionality. Currently, our code coverage is adequate but unideal.

We are missing testing on a few trivial methods (such as setters within the controller classes), so we are currently focused on ensuring we have (nearly) complete coverage.