Design Decisions

Frontend

Angular

For our frontend framework, we chose Angular 4. Angular 4 is extensible, and it can be used in web, mobile, and desktop applications. Angular 4 has some powerful testing frameworks such as jasmine or mocha. As a final reason as to why we chose Angular 4, because it is actively maintained.

Jasmine

We chose jasmine to test our framework because it supports testing front-end code, and works very well with Angular.

Backend

Docker

We chose Docker because it helps tremendously with security. Docker essentially creates lightweight VMs (containers) where we can add whatever dependencies, software, etc. to that container. The student's code is restricted to that container, and cannot access files outside of it, which eliminates a security concern for us. We can also safely destroy Docker containers should the process take too long, and errors that occur within a Docker container do not affect the rest of the system.

Docker is also flexible. Any number of dependencies can be downloaded and used to create an image. We utilized this flexibility to easily create images to run any coding language. If a professor creates a python assignment, we can create a container that runs and compiles the python language. We can also do this with java, and this flexibility allows for additional language support to be added with relative ease.

Spring

We chose Spring because it is a Java-based framework commonly used for developing web applications. Spring allows the development team to move as quickly as possible because of its capabilities for configuration and dependency injection. A Java-based framework also works well for the team as all developers are well versed in Java development.

Database

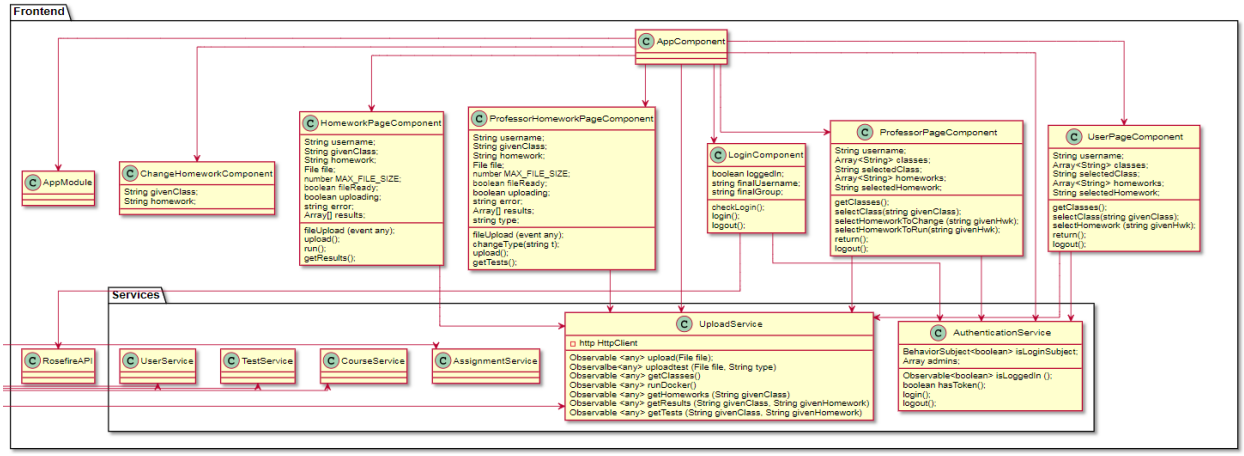
MongoDb

MongoDB is a object-oriented NoSQL database. MongoDB was the right choice for Compile.io because of how flexible and extensible it is. In addition to being a powerful database, if the clients wish to extend the application they can do so with ease.

High Level Overview

Our Entire UML diagram can be viewed with this Link, under the UML Folder that this link goes to
https://github.com/CompileIO/compile.io/tree/develop/Documentation

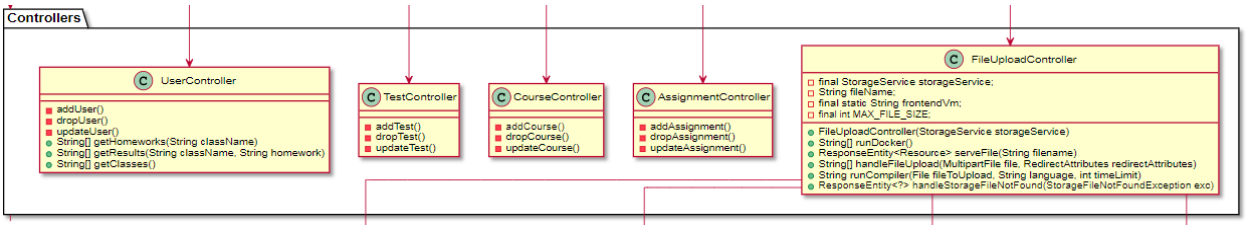
Frontend



Our Frontend like we said was designed through Angular 4, and it has pages listed out that all use a service that Angular uses to talk to the backend. These Services deal with one portion of our backend whether it be Courses, Test, Professors, Students, or Assignments.

Those Services are able to communicate to the Spring Backend via http requests (Get, Post, Put, Delete). For Example http://{serverIP}/upload/run along with a file in the body of that http request will
trigger a function on the backend.

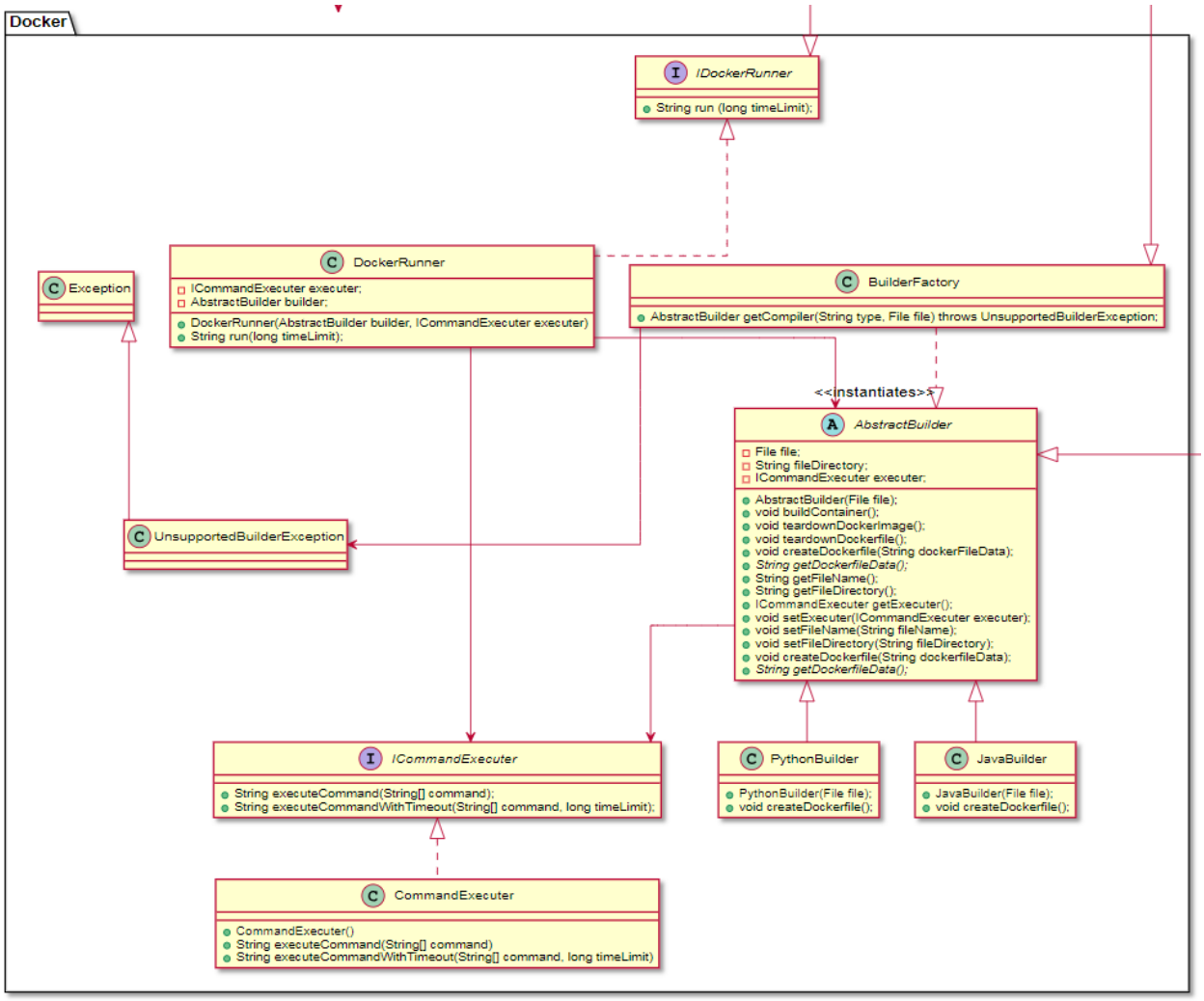
Backend - Controllers

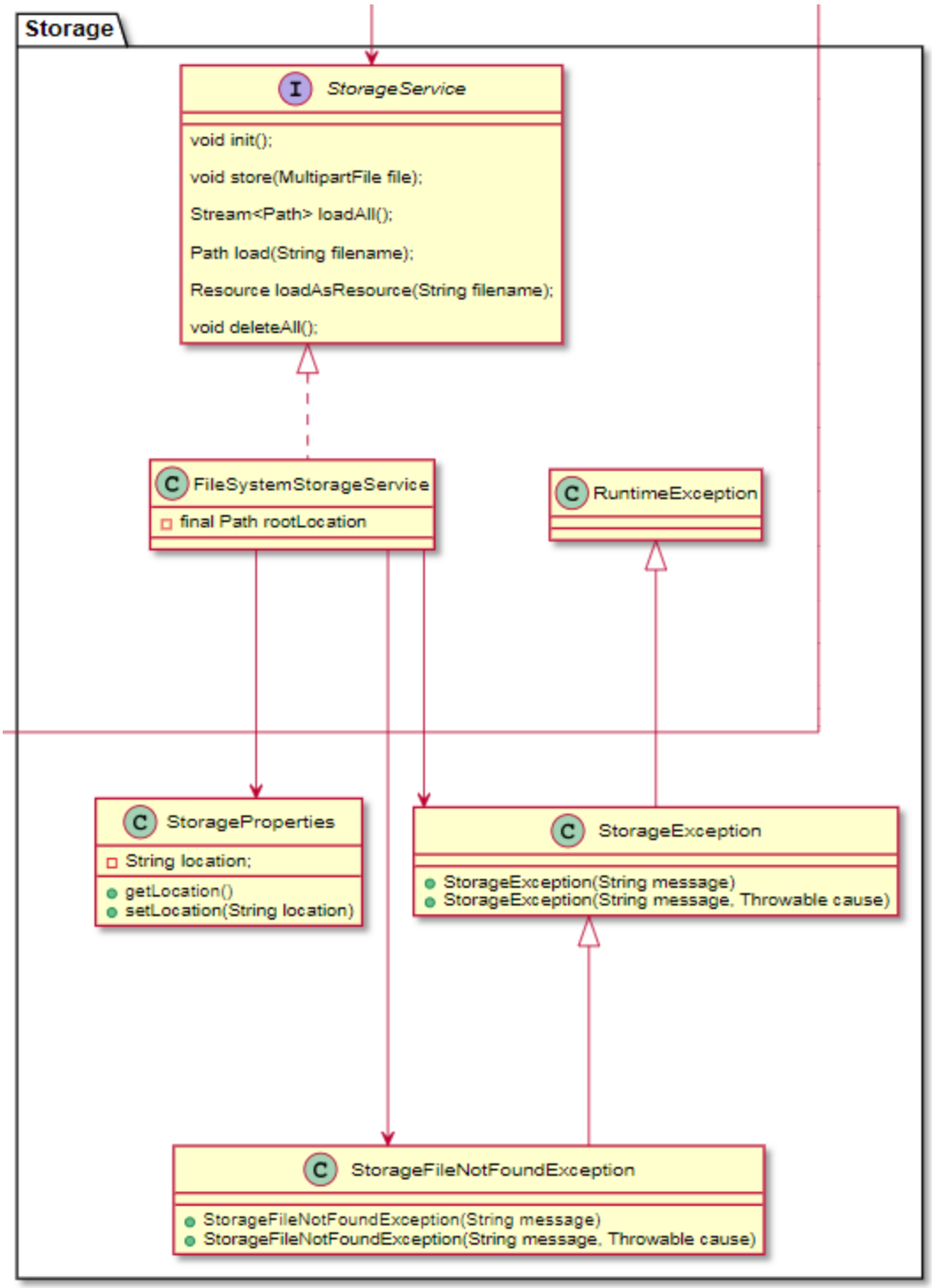


These controllers lay inside of our backend with spring, and act as the receiving end of that http://{serverIP}/upload/run call. So that Users call will map to a method in the Usercontroller called runDocker. When that call is triggered the file will be stored inside our directory so Docker can receive that file and begin to run on the file that it received from the frontend. The following two snippets are the packages that contain docker calls, and storage calls.

** It is to be noted that the Server needs to be running on the server for the calls to be mapped. The Server runs on port 8080, and the front end runs on port 4200. The backend knows to only talk to port 4200 through our globally enforced CORS talked about in the Security portion of this document.

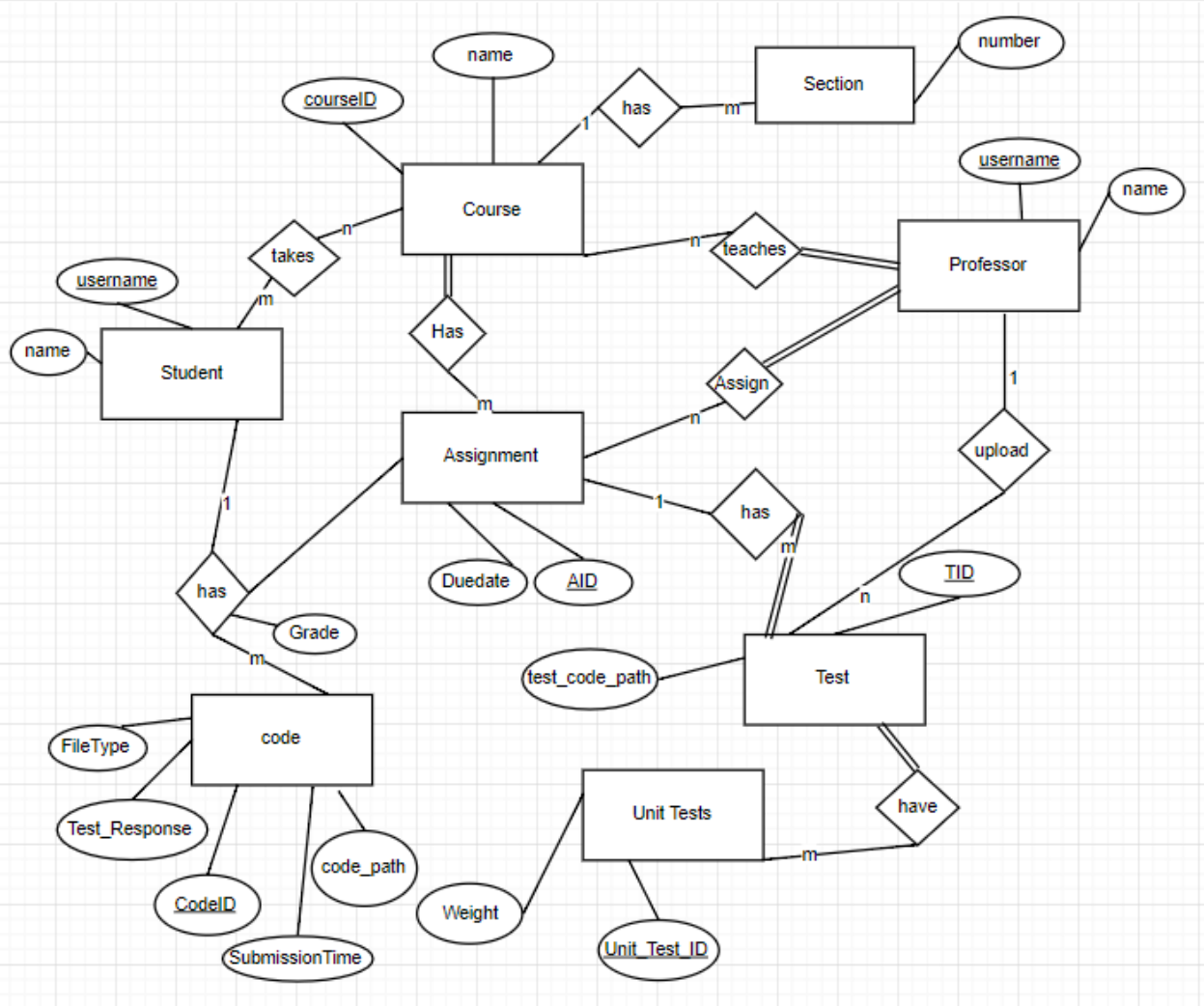
Backend Docker and File Storage





After the file is stored and Docker is run, the results of that run will be stored in MongoDB, which is also connected to Spring via a config file, just like the server, mongo needs to be running on the server on port 27017, Mongo is secured by our authentication. In Spring's config file we give Mongo which port to look at, and what the username and password of Mongo is.

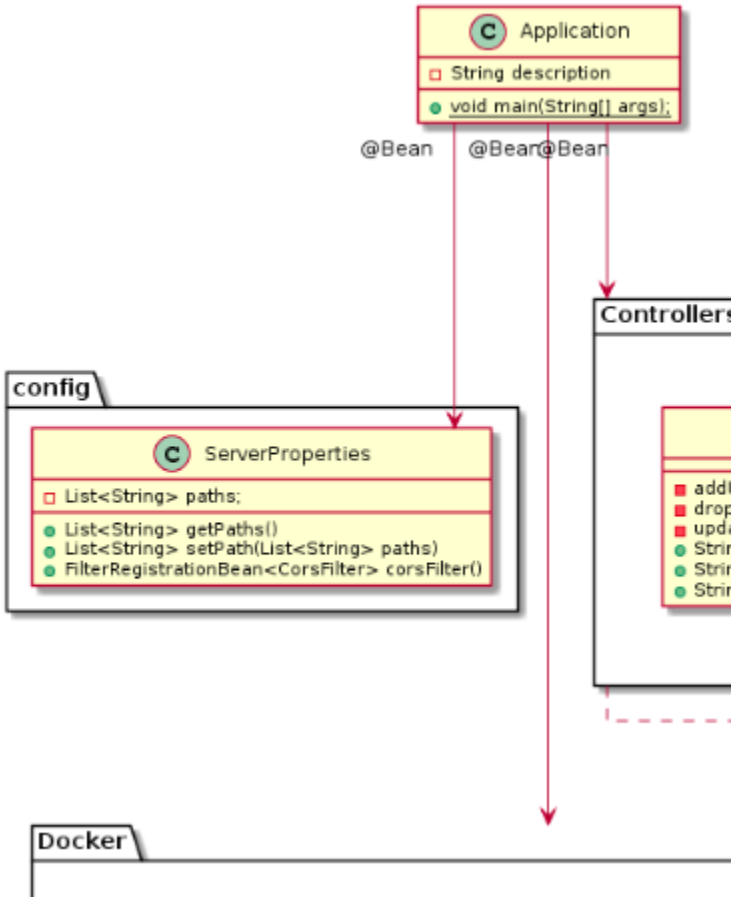
Database - MongoDB



The above is how our MongoDB is set up, and there is one controller, for one model. The code controller is what would be called in the runDocker method. Once Docker receives the test response, the controller will save that response in the attribute test_repsonse for that specific code piece, and the response will be sent to the frontend for viewing via a return statement.

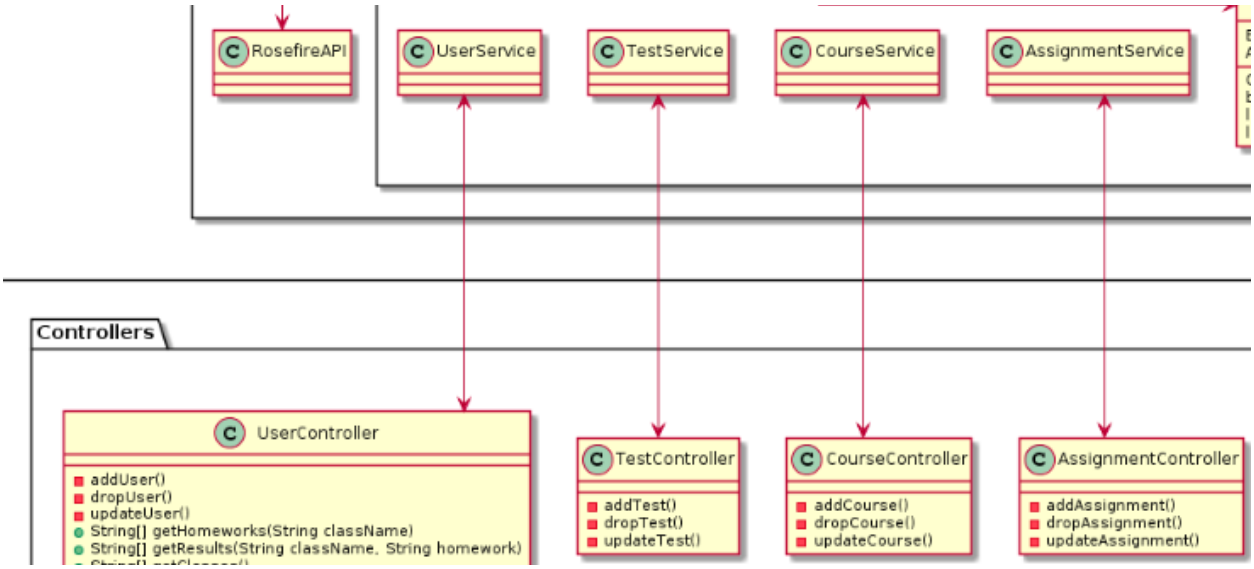
Design Pattern Decisions

Dependency Injection



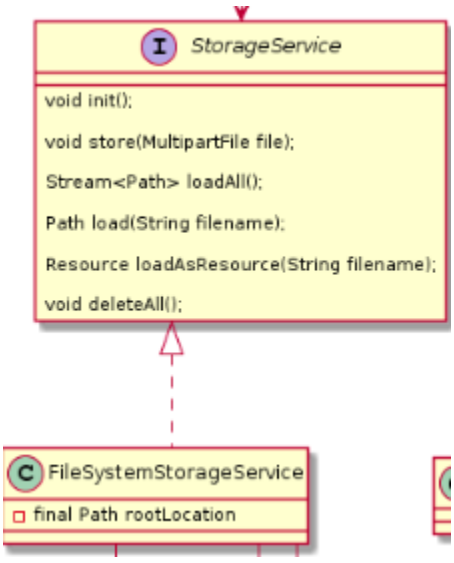
One Example of Dependency Injection is how our application class runs our different packages in the backend. Spring has a annotation named @bean that connects one piece of code to another through dependency injection. For example Spring runs our Docker package with just 3 lines of code annotated with @bean, the same goes for the controllers. All of the arrows in the above picture are dependency injection arrows through the @bean property part of Spring.

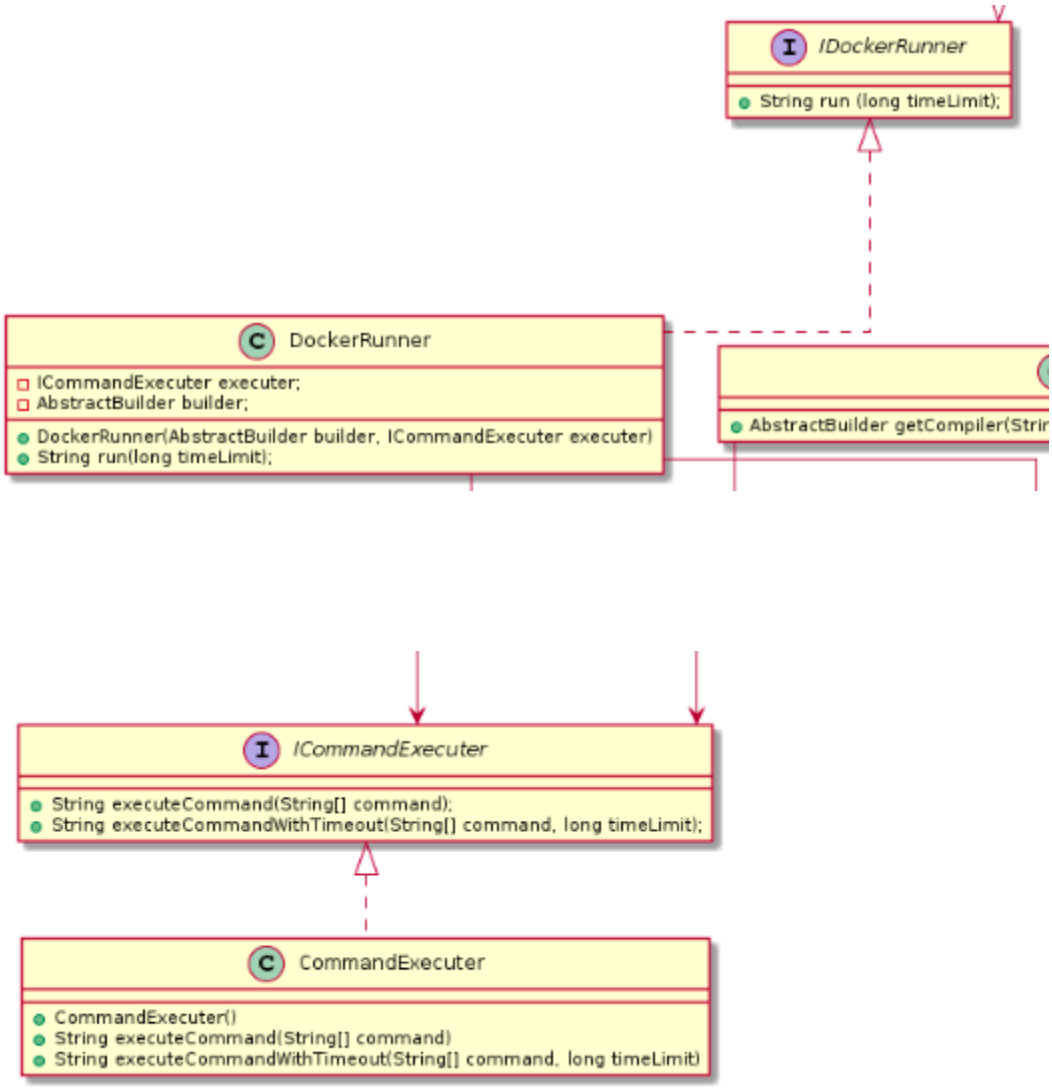
Single Responsibility Principle



This Design decision for having one frontend service talk to one backend controller falls most closely with the single responsibility principle. This principle is prevalent in our software, as we have partitioned each class to do only one thing, but is easiest to see in the above picture. Users have their own service and controller, as do Tests and so on and so forth.

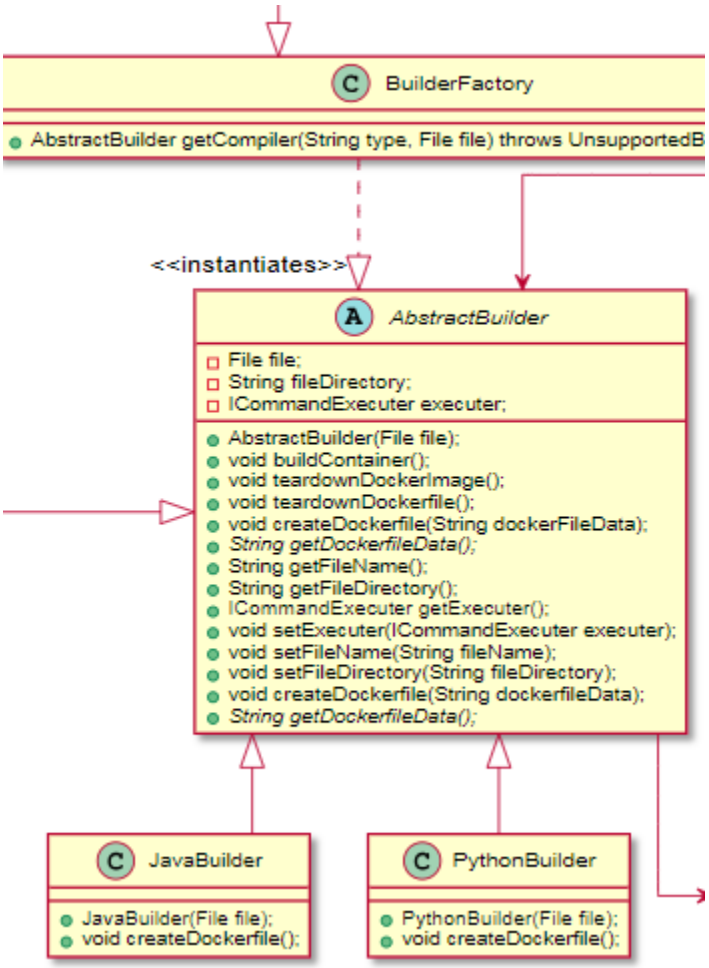
Composition over inheritance





The above three snippets of our UML are examples of Programming to an interface or following the principle of composition over inheritance. This helps with code reuse which maximizes the benefit of using an object-oriented programming language such as java.

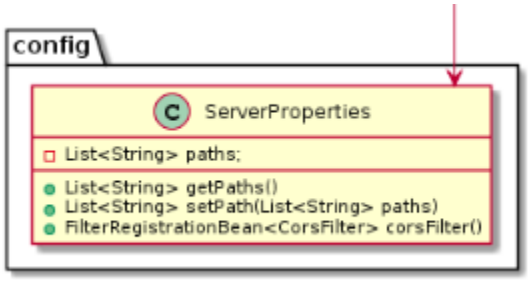
Builder Pattern



This Factory pattern was used because it allows us to flexibly add more language support for Compile.io on the backend. We started off by using a Simple Factory Pattern, which contained a nested `if` statement. So, if a programmer wanted to add another return statement in the Factory, they'd have to go in an make modifications to legacy code. This violates the open/close principle. In order to move away from this, we will be moving to an Abstract Factory Pattern in the future, coming in the next release (release 3.0). This is more flexible than a simple factory, as it allows developers to add return values to the factory, without violating the open/close principle. This is accomplished via a Map, which programmers can add keys and values to, thus expanding the factory. In this scenario, add a new Map entry would be like extending the nested `if` statement from the Simple Factory Pattern.

Security

Globally apply CORS to application



Anyone within the rose-hulman network could have been able to access our server, and our code if it wasn't for our globally configured Cors (Cross-origin resource sharing) filter. This Filter is run through dependency injection into our application class in the ServerProperties class, which also initializes the server to accept localhost when we are running in Development, or to our VM's if we are running in production. Another feature that this class has to offer is that it is directly tied to the properties folders and builds a "configuration file" every time we run the app.