Mock Stock

Project Team: Luke Orr, Theodore Hecht, Sebastian Schwagerl, Jonathan Langston

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1. Project Definition (100 - 200 words**)** – *Group responsibility*

Some people want to learn about and practice stock trading without any financial commitment. Because of this, we have decided to create a mobile app that will allow people to learn about the stock market. Our users will be able to learn using a "hands on" approach, allowing them to trade "mock" stocks with virtual currency. This project will be created as a mobile app for the iOS operating system using Swift 4 and XCode, with a restful web API backend in .NET Core with a SQL database layer to hold user details, all created by the Mock Stock team.

2. Project Requirements – *Group responsibility*

- Functional
    - The backend API must be able to query real-time financial data (stock prices) from a third party API.
    - The backend API must have middleware to authenticate users who make requests from the mobile app. (Our authentication solution may also have database requirements, like storing usernames/emails and hashed passwords.)
    - The backend API must be able to store and retrieve information about the user's virtual portfolio, exposed as a set of REST API endpoints that the frontend can access.
    - The frontend should let users buy/sell virtual stocks at real-world prices.
    - The frontend should let users examine their portfolio contents.
    - The frontend should allow users to display detailed information on specific companies.
    - The frontend should have a search/sort button to find specific stocks that the users wants.
    - The frontend should have a button to change the graphical timeline of the price history of the stock.
- Usability
    - User interface
        - Efficiency of use
        - Intuitive design
    - Performance
        - UI must be fast and responsive
        - API calls needs to be efficient

        - Database calls need to run quickly
- System
    - Hardware
        - Frontend: iOS device (phone), 6s and above
    - Software
        - Frontend: iOS current version
        - Backend: PaaS (Azure App Service)
    - Database
        - SQL database options: MySQL, PostgreSQL, MariaDB
- Security
    - Basic authentication middleware over HTTPS. Frontend sends username/password combo on each request encrypted over HTTPS, and backend middleware authenticates the request using this information.

3. Project Specification – *Group responsibility*

- Focus / Domain / Area
    - Stock market learning tool
- Libraries / Frameworks / Development Environment
    - Frontend: Swift4, UIKit (and other native iOS libraries), XCode
    - Backend: C#, .NET Core 2.X
- Platform (Mobile, Desktop, Gaming, Etc)
    - Mobile (iOS)
- Genre (Game, Application, etc)
    - Game/Education

4. System – Design Perspective – *Group responsibility*

- Identify subsystems – design point of view

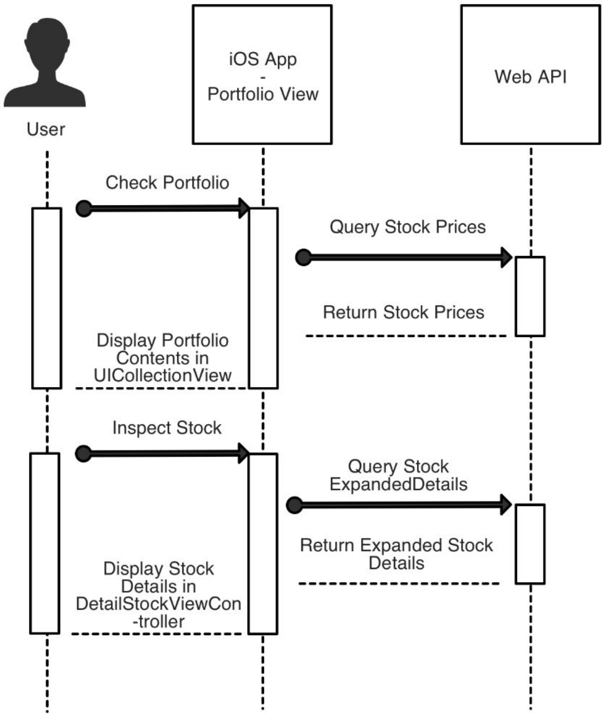
Front End Screens: (Portfolio, Leagues, Marketplace, Detailed Stock View).

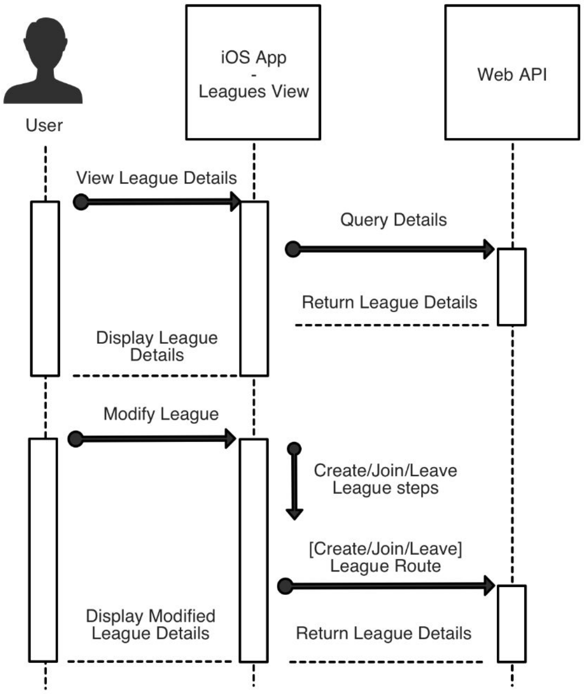
Portfolio Screen: This screen shows the user’s portfolio. It contains a list of stocks the user owns, along with their current prices and the entire portfolio worth. It gets the current details for the portfolio from the backend API. The user can click a specific stock to see its expanded details (price history, etc.).

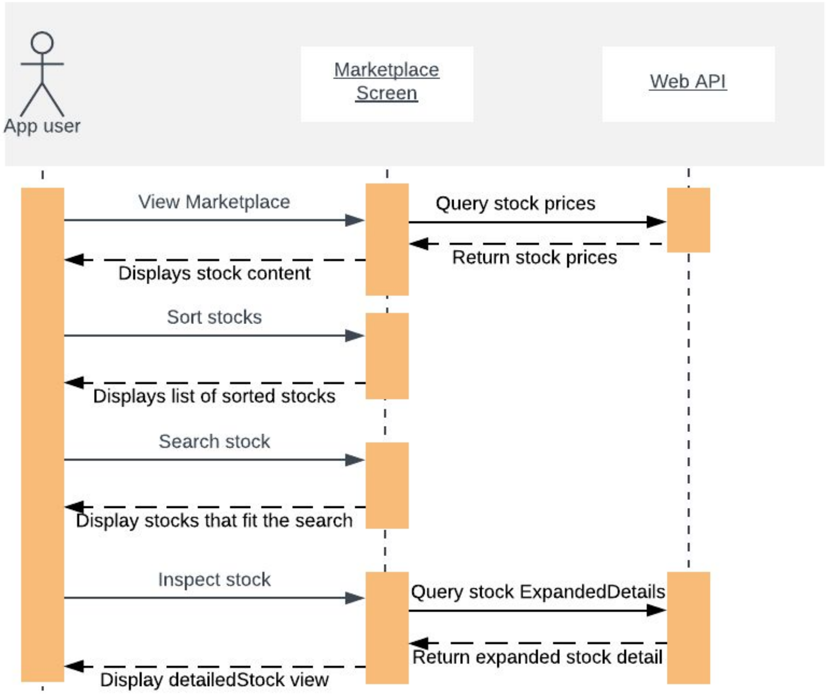
Leagues Screen: This screen shows all the leagues a user is a member of. A league is a competitive leaderboard with one or more users. Users can click on a league to see the current league details (a list of league members and their portfolio values.) Users can create, join, or leave leagues from this screen.

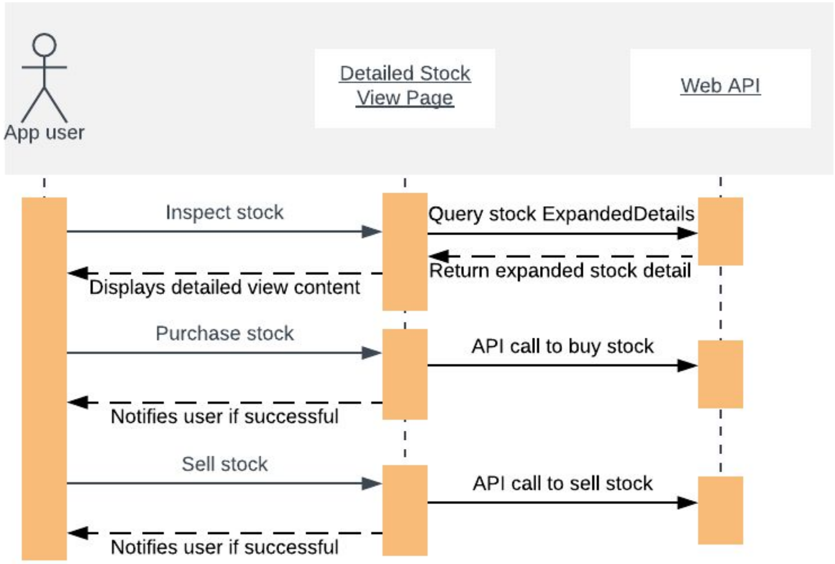
Marketplace Screen: This screen shows the stock marketplace. It contains a list of sorted stocks based on the users sort selection. The user will also be able to search stocks based off company name or ticker symbol. Current stock information will be obtained via the IEX api. The user can click a specific stock to see its expanded details (price history, etc.).

Detailed Stock View Screen: This screen shows the detailed view of a specific stock. The screen will display stock details such as price, today's change, change in the past year, as well as a graphical representation of the stocks price fluctuation. From this screen users will also be able to buy and sell stocks.


User
iOS App
-
Portfolio View
Web API
Check Portfolio
Query Stock Prices
Return Stock Prices
Display Portfolio Contents in UICollectionView
Inspect Stock
Query Stock ExpandedDetails
Return Expanded Stock Details
Display Stock Details in DetailStockViewCon -troller


User
iOS App
-
Leagues View
Web API
View League Details
Query Details
Return League Details
Display League Details
Modify League
Create/Join/Leave League steps
[Create/Join/Leave] League Route
Display Modified League Details
Return League Details


App user
Marketplace Screen
Web API
View Marketplace
Query stock prices
Return stock prices
Displays stock content
Sort stocks
Displays list of sorted stocks
Search stock
Display stocks that fit the search
Inspect stock
Query stock ExpandedDetails
Return expanded stock detail
Display detailedStock view

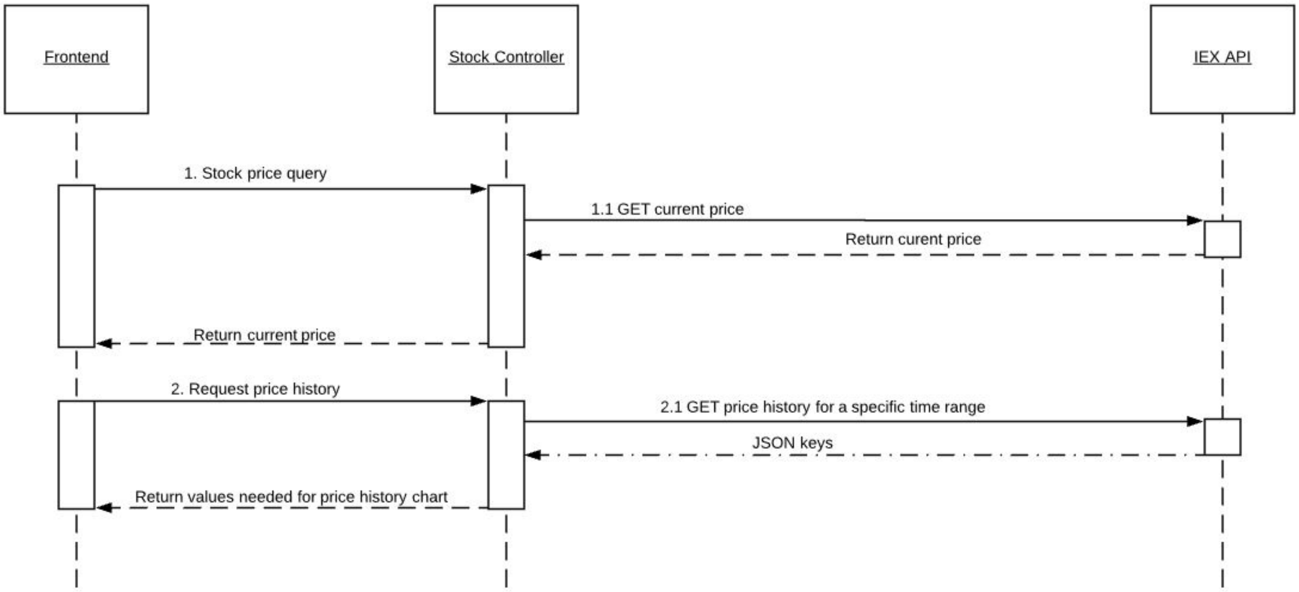

App user
Detailed Stock View Page
Web API
Inspect stock
Query stock ExpandedDetails
Return expanded stock detail
Displays detailed view content
Purchase stock
API call to buy stock
Notifies user if successful
Sell stock
API call to sell stock
Notifies user if successful

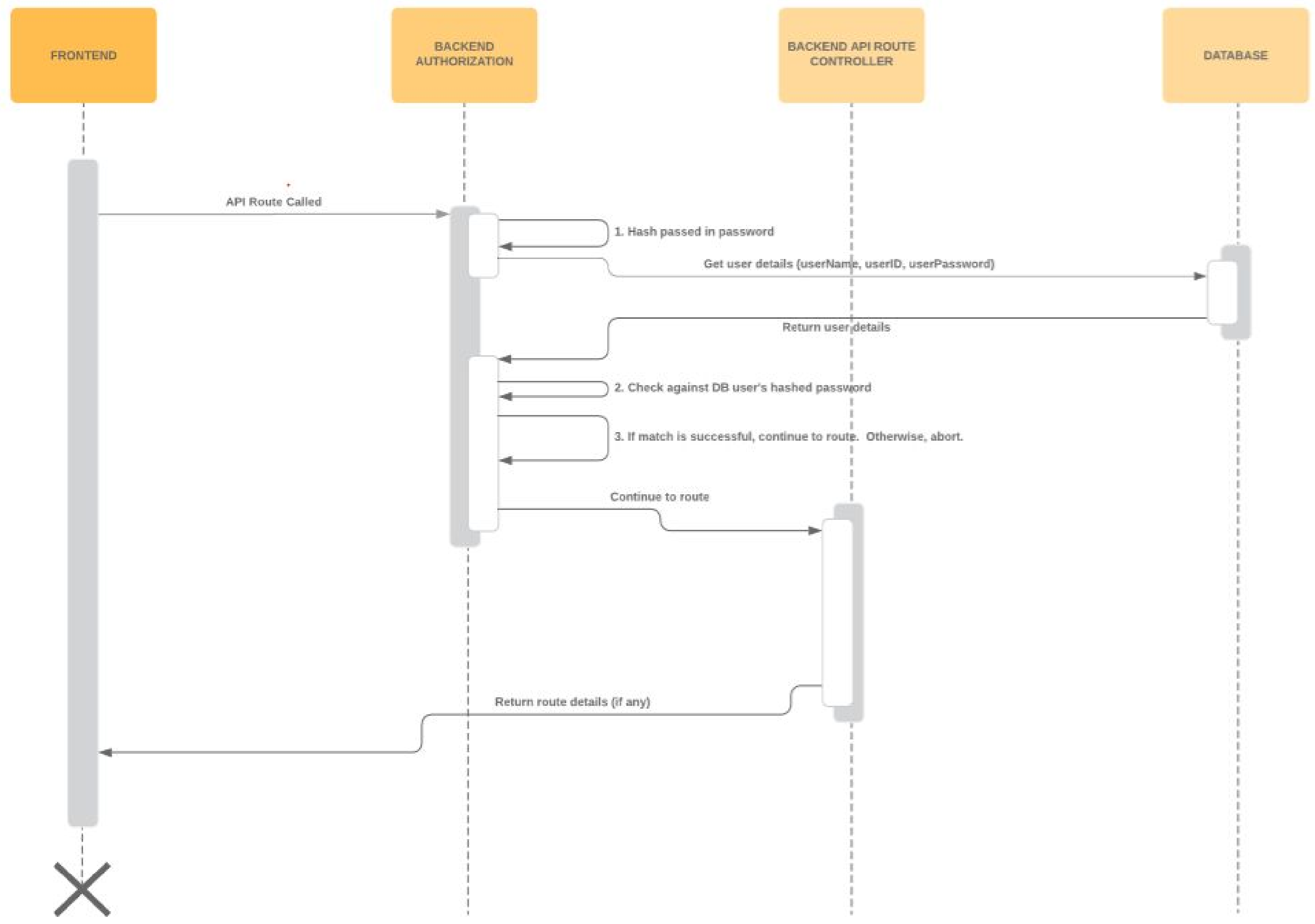
Backend Subsystems: (Authentication Middleware, Database Layer, 3rd Party API)

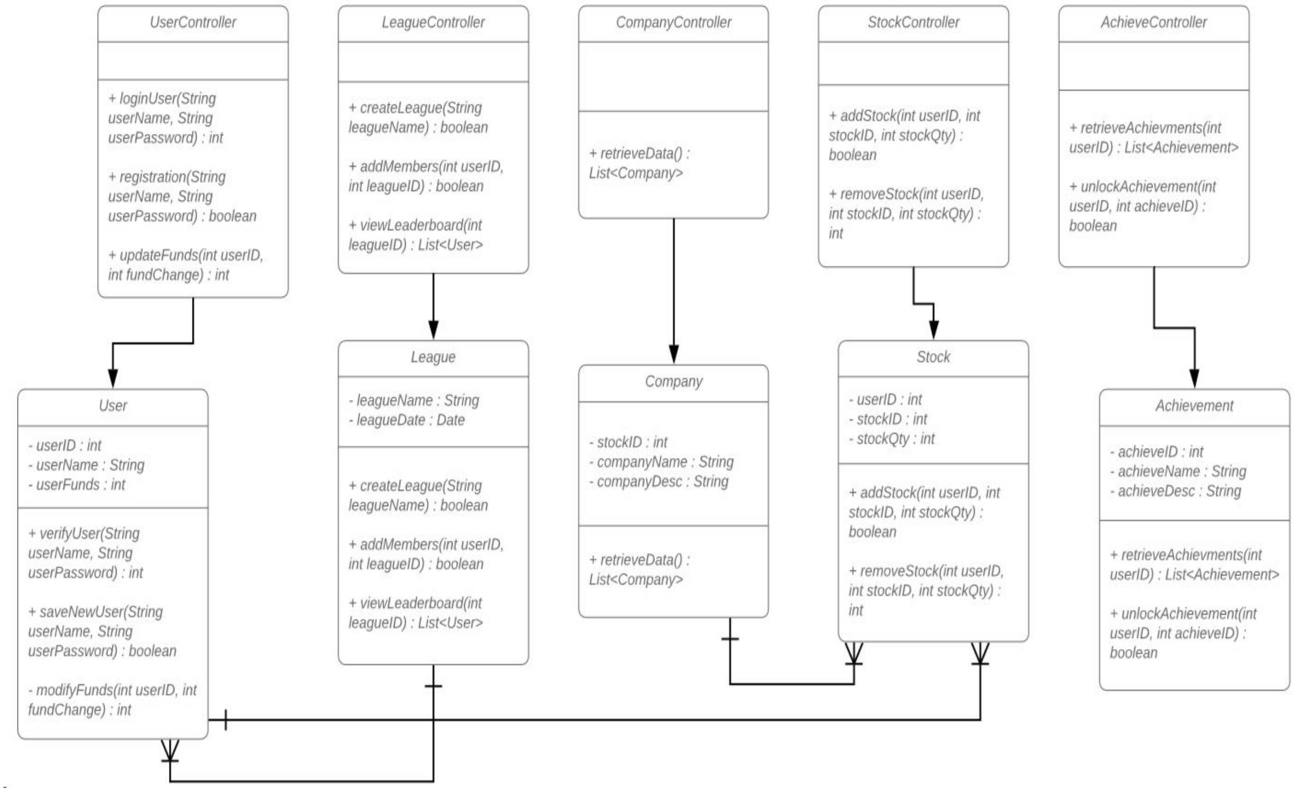
3rd Party API: A 3rd party API is needed in order to gather the information needed on stock prices and their details. The IEX API is used for this purpose since it can provide real-time data for free. This will be called from the backend API when the frontend needs the stock information.

Authentication Middleware: Authentication is performed before any call to the backend API route controllers, to verify that the user is who it is. It will hash the password provided, and compare it to the one that is stored on the database. If they match, it will continue to its intended destination on the backend, though if it fails, it will abort and throw an error.

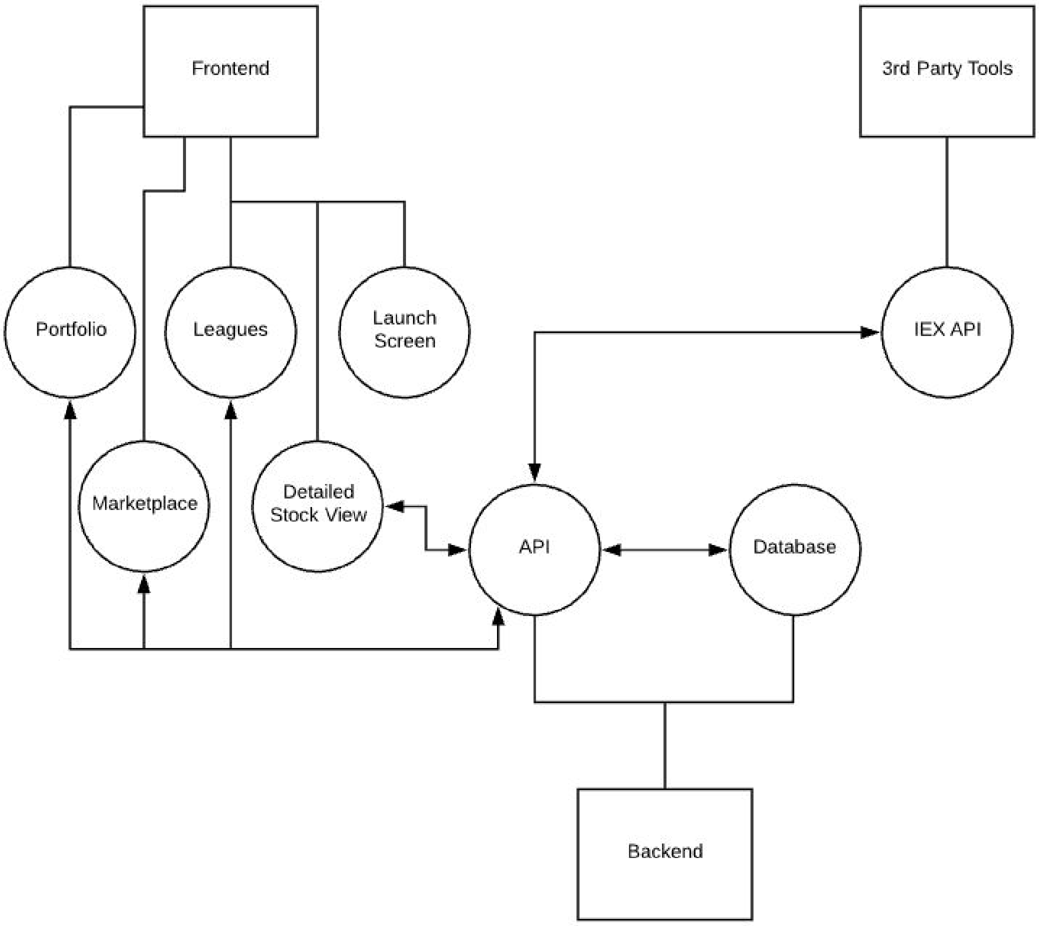
Database Layer: The database classes are split into 5 categories: User, League, Company, Stock, and Achievements. They will be reachable through their respective controllers, depending on the actions on the view. There may likely be a model that handles SQL connections that all 5 other models will connect to, though it will depend on the complexity of the SQL formulas.




FRONTEND
BACKEND AUTHORIZATION
BACKEND API ROUTE CONTROLLER
DATABASE
API Route Called
1. Hash passed in password
Get user details (userName, userID, userPassword)
Return user details
2. Check against DB user's hashed password
3. If match is successful, continue to route. Otherwise, abort.
Continue to route
Return route details (if any)


UserController
+ loginUser(String userName, String userPassword) : int
+ registration(String userName, String userPassword) : boolean
+ updateFunds(int userID, int fundChange) : int
LeagueController
+ createLeague(String leagueName) : boolean
+ addMembers(int userID, int leagueID) : boolean
+ viewLeaderboard(int leagueID) : List<User>
CompanyController
+ retrieveData() : List<Company>
StockController
+ addStock(int userID, int stockID, int stockQty) : boolean
+ removeStock(int userID, int stockID, int stockQty) : int
AchieveController
+ retrieveAchievments(int userID) : List<Achievement>
+ unlockAchievement(int userID, int achieveID) : boolean
User
- userID : int
- userName : String
- userFunds : int
+ verifyUser(String userName, String userPassword) : int
+ saveNewUser(String userName, String userPassword) : boolean
- modifyFunds(int userID, int fundChange) : int
League
- leagueName : String
- leagueDate : Date
+ createLeague(String leagueName) : boolean
+ addMembers(int userID, int leagueID) : boolean
+ viewLeaderboard(int leagueID) : List<User>
Company
- stockID : int
- companyName : String
- companyDesc : String
+ retrieveData() : List<Company>
Stock
- userID : int
- stockID : int
- stockQty : int
+ addStock(int userID, int stockID, int stockQty) : boolean
+ removeStock(int userID, int stockID, int stockQty) : int
Achievement
- achieveID : int
- achieveName : String
- achieveDesc : String
+ retrieveAchievments(int userID) : List<Achievement>
+ unlockAchievement(int userID, int achieveID) : boolean

- Sub-System Communication

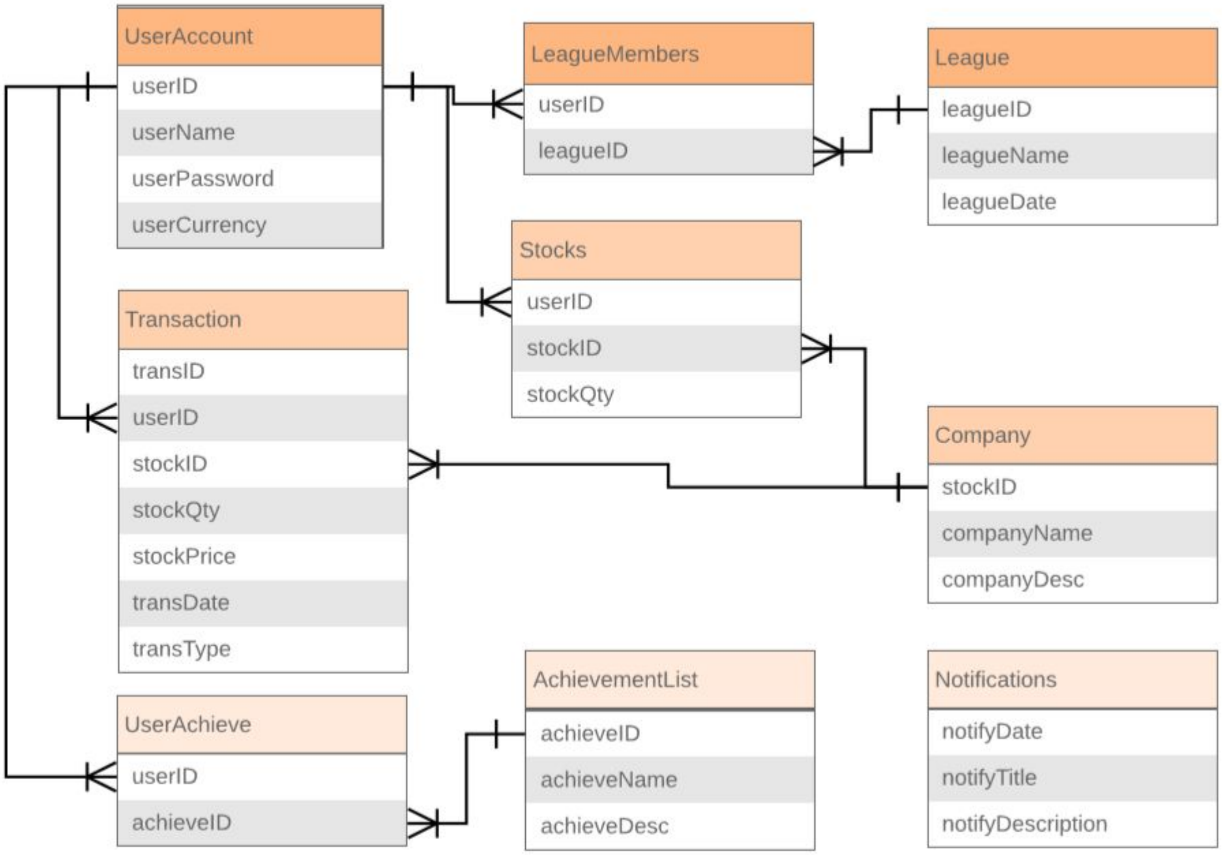


- The frontend is made up of multiple screens that interact with the backend API after being verified through the middleware authentication. They call the API when some kind of information is needed, which it will then communicate with the database or the 3rd party stock API (IEX) to get that information and supply it to the frontend. The Portfolio and League screens will be sent information on the user from the database. The Detailed Stock View and Marketplace screens will be sent information on current stock prices from the IEX API. When stocks are bought or sold, the API will need to interact with the database to update information on the user’s ownership of the stocks and IEX to get the current price to update the user’s currency.

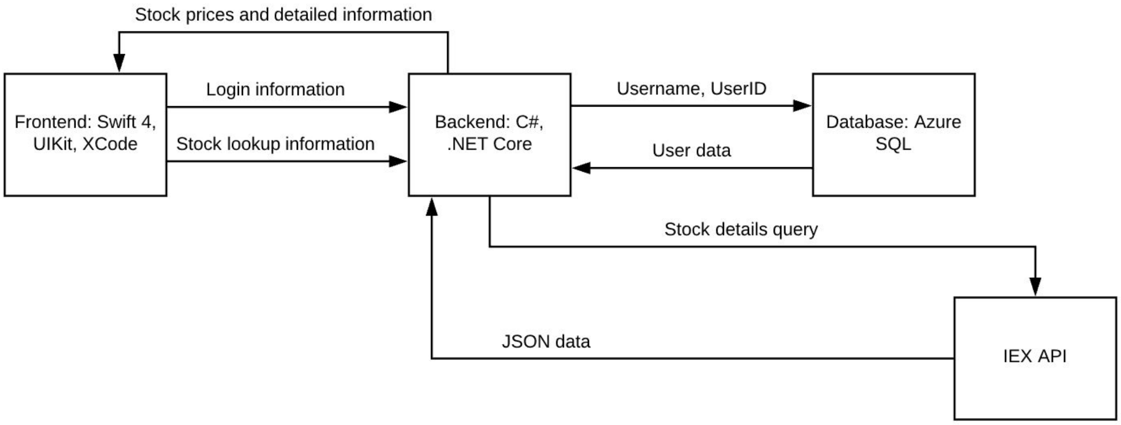
API Routes (Front to Back end communication. All data passed is in JSON.)

Route	Description
GET /api/portfolio	Returns the authenticated user's portfolio details. (User currency, list of current stocks owned + amount of each owned, prices of each stock at the moment.)
GET /api/stock/symbols	Returns a list of stock details (prices, etc.) for the given symbols.
POST /api/stock/buy	Buys a stock. Expects the ticker symbol of the stock to buy and the amount of stock to buy.
POST /api/stock/sell	Sells a stock. Expects the ticker symbol of the stock to sell and the amount of stock to sell.
GET /api/leagues/id	Returns league details. (Members and portfolio values.)
POST /api/leagues/create	Creates a new league. Returns the uniquely created league id, and registers the authenticated user as the league owner.
DELETE /api/leagues/	Deletes a league, if the authenticated user is the owner. Expects the league id.
POST /api/leagues/join/{leagueid}	Joins a league with the authenticated user. Expects the league id.
DELETE /api/leagues/leave/{leagueid}	Leave a league
DELETE /api/leagues/kick/{leagueid}/{userid}	Kicks a user from a league
GET /api/transactions	Get a list of previous transactions for the user

- Entity Relationship Model (E-R Model)



- Overall operation - System Model



5. System – Analysis Perspective – *Group responsibility*

- Identify subsystems – analysis point of view
- Backend: Web API + Database
    - C# and .NET Core were chosen because of a combination of developer familiarity (with C#) and cross platform ability. We can run a .NET Core backend on Windows and Mac, meaning our front end iOS team can develop with the backend code running for development/testing purposes. (This wouldn't be possible with older versions of .NET, which are Windows only.)
    - There are several different options for hosting our web application, the primary ones being Microsoft's Azure and Amazon's Web Services. We ended up choosing Azure, due to strong integration with Microsoft's .NET ecosystem and its pricing. Azure App Services allows 10 free applications, with no need to micromanage virtual machines, and allows us to scale those applications out horizontally with increased instances if we need them. Azure also provides a month of free credits to be used for cloud PostgreSQL database services, which we can activate near the delivery date of the project. However, beyond the free month, PostgreSQL would cost money to host on Azure, whereas Azure SQL could be hosted free for a year. But since our frontend development team will develop with MacOS for iOS development, it would be ideal to use a database capable of running locally on those computers, which Azure SQL was not made to do.
- Frontend:
    - Swift4 and UIkit were chosen for the front end for a couple of reasons. One is that overall the development team is more familiar with IOS development compared to Android. Another reason is because IOS beats out android when it comes to development complexity. Android has more devices and OS versions to worry about compared to IOS. In 2018 over 50% of IOS devices were running on IOS 12 (the most current version) compared to android where only .1% of users were running on Android 9 Pie and 14.6% on Android 8 and 8.1 Oreo. Because of those reasons, developing for IOS would result in a less complex app building process.

- System (Tables and Description)
  - Data analysis
    - Data dictionary (Table - Name, Data Type, Description)

Name	Data Type	Description
userID	integer	Used for tracking the user with one value.
userName	string	The entered username. Paired with password to access.
userPassword	string	Will be hashed before being stored. Entered password is compared to stored hashed password.
userCurrency	double	The current unused funds on a user’s account.
leagueID	integer	Used for tracking league.
leagueName	string	Name assigned to league upon creation.
leagueDate	DateTime	Date and time league was created. For use in record keeping, or potential deadlines.
stockID	integer	Used for tracking companies and stocks.
stockQty	integer	The number of stocks owned by a user for a specific company.
companyName	string	Name of Company
companyDesc	string	Short description of company, like what they sell, or what services they provide.
transID	integer	Used for tracking a transaction; for when a user buys or sells a stock. Transaction History.
stockPrice	double	Price paid or earned from buying/selling a stock.
transDate	DateTime	Time at which the exchange occurred.
transType	string	Determine if the stocks were bought, sold, or any other options.

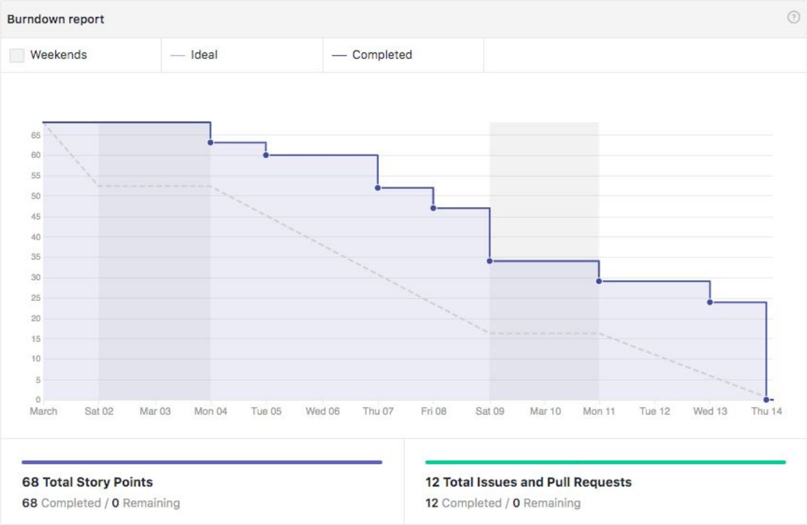
achieveID	int	Used for tracking various achievements.
achieveName	string	Title of Achievement.
achieveDesc	string	Description of Achievement Requirements
notifyDate	DateTime	Date at which notification was created. May last a certain amount of time beyond creation.
notifyTitle	string	Header of notification.
notifyDesc	string	Body of notification. For updates to the product, or for ongoing events.

    - Process models
      The process model we will be using is Agile and Scrum. Agile was chosen because of its emphasis on less documentation and more developing. This process model will us to focus more on productive work compared to other more plan heavy models such as waterfall. We will also be using the Scrum process framework which is a subset of Agile. Scrum was chosen because of the benefits it provides, such as providing estimates on how long certain features will take to implement with the product backlog. It will also allow us to be in control of the project schedule with the use of a burn-down chart and product backlog.
- Algorithm Analysis
    - Search: When searching, we will have a list of stocks in a users portfolio or a list of stocks in the market stored on the device. Searching through this list would take at most the entire length of the list, meaning the time complexity of searching will be O(N).
    - Sort: Sometimes users will want to sort stock entries (for example, by current value, or by their growth over a certain period of time.) Merge Sort would give us a worst case of O(n*log(n)) for sorting on current price. Sorting on the growth over a given period of time would be the same complexity, since computing growth-over-time for each sorted stock could be done within the sorting algorithm and would just add extra constant-time computations, which we could ignore. But if we computed the growth-over-time outside of the sort, it would be O(n + (n * log(n))), since we would need to iterate over the list first before sorting.

6. Project Scrum Report - *Group Responsibility*

Below is the backlog of tasks and burndown chart for each sprint. Our overall product backlog is simply the sum of these sprint backlogs.

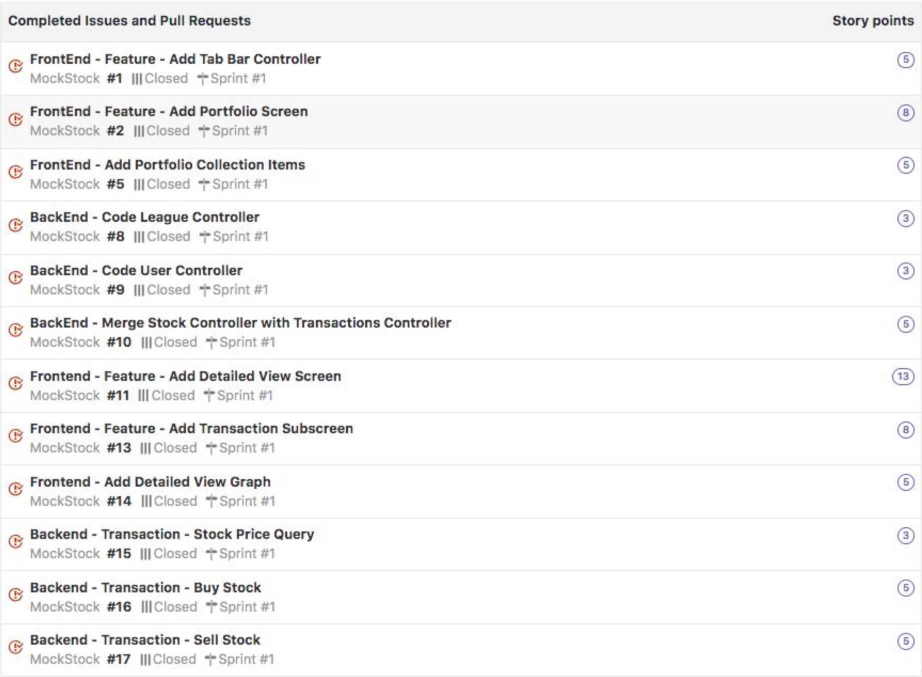
Sprint #1 Burndown Chart:



68 Total Story Points
68 Completed / **0** Remaining

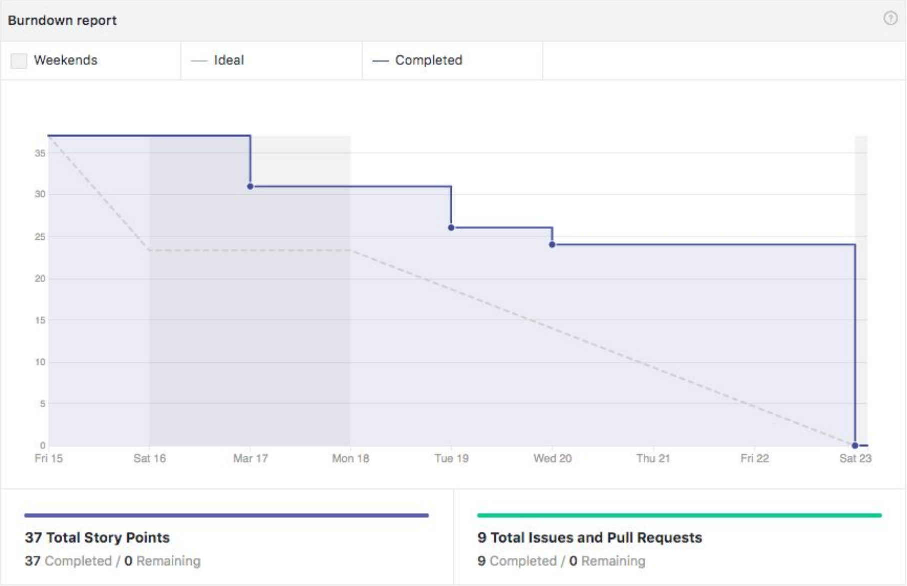
12 Total Issues and Pull Requests
12 Completed / **0** Remaining

Sprint #1 Product Backlog



Completed Issues and Pull Requests	Story points
FrontEnd - Feature - Add Tab Bar Controller MockStock **#1** Closed Sprint #1	5
FrontEnd - Feature - Add Portfolio Screen MockStock **#2** Closed Sprint #1	8
FrontEnd - Add Portfolio Collection Items MockStock **#5** Closed Sprint #1	5
BackEnd - Code League Controller MockStock **#8** Closed Sprint #1	3
BackEnd - Code User Controller MockStock **#9** Closed Sprint #1	3
BackEnd - Merge Stock Controller with Transactions Controller MockStock **#10** Closed Sprint #1	5
Frontend - Feature - Add Detailed View Screen MockStock **#11** Closed Sprint #1	13
Frontend - Feature - Add Transaction Subscreen MockStock **#13** Closed Sprint #1	8
Frontend - Add Detailed View Graph MockStock **#14** Closed Sprint #1	5
Backend - Transaction - Stock Price Query MockStock **#15** Closed Sprint #1	3
Backend - Transaction - Buy Stock MockStock **#16** Closed Sprint #1	5
Backend - Transaction - Sell Stock MockStock **#17** Closed Sprint #1	5

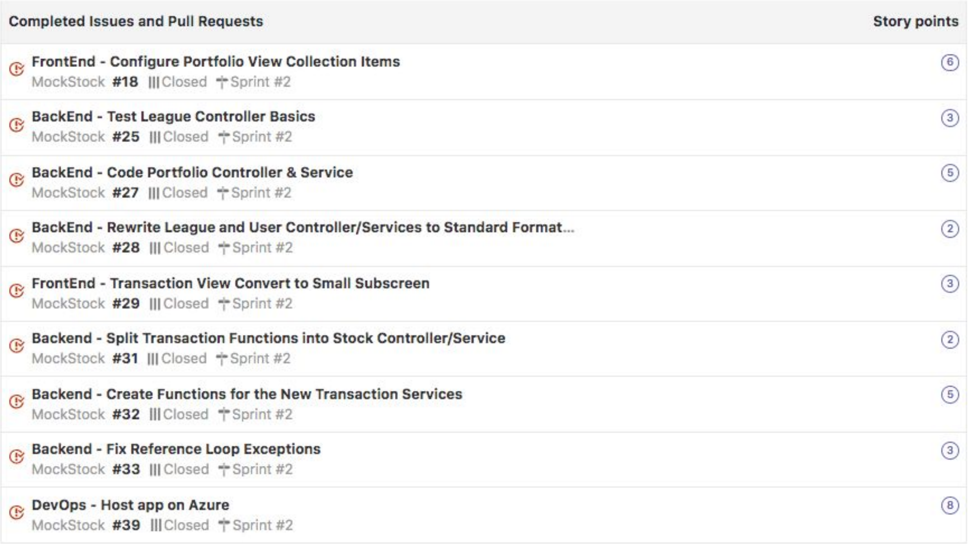
Sprint #2 Burndown Chart:



37 Total Story Points
37 Completed / **0** Remaining

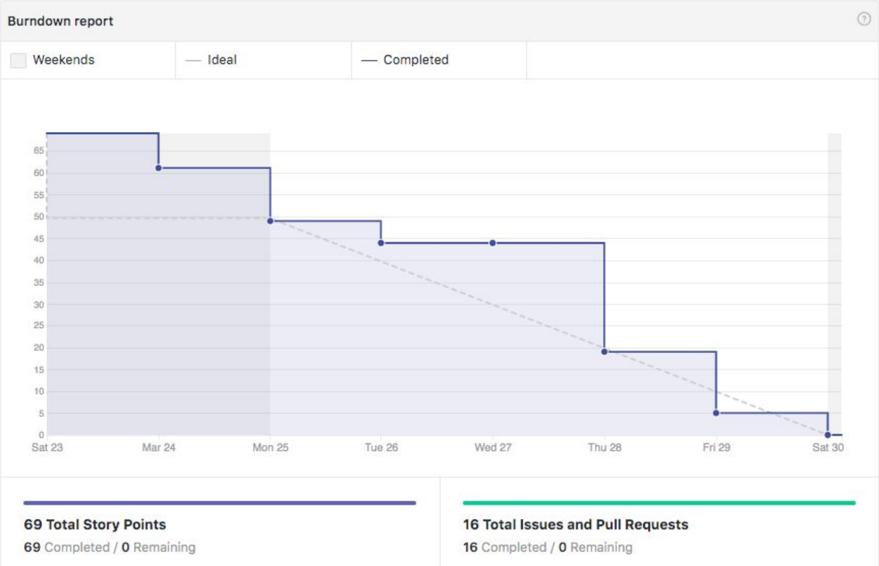
9 Total Issues and Pull Requests
9 Completed / **0** Remaining

Sprint #2 Product Backlog



Completed Issues and Pull Requests	Story points
FrontEnd - Configure Portfolio View Collection Items MockStock **#18** Closed Sprint #2	6
BackEnd - Test League Controller Basics MockStock **#25** Closed Sprint #2	3
BackEnd - Code Portfolio Controller & Service MockStock **#27** Closed Sprint #2	5
BackEnd - Rewrite League and User Controller/Services to Standard Format... MockStock **#28** Closed Sprint #2	2
FrontEnd - Transaction View Convert to Small Subscreen MockStock **#29** Closed Sprint #2	3
Backend - Split Transaction Functions into Stock Controller/Service MockStock **#31** Closed Sprint #2	2
Backend - Create Functions for the New Transaction Services MockStock **#32** Closed Sprint #2	5
Backend - Fix Reference Loop Exceptions MockStock **#33** Closed Sprint #2	3
DevOps - Host app on Azure MockStock **#39** Closed Sprint #2	8

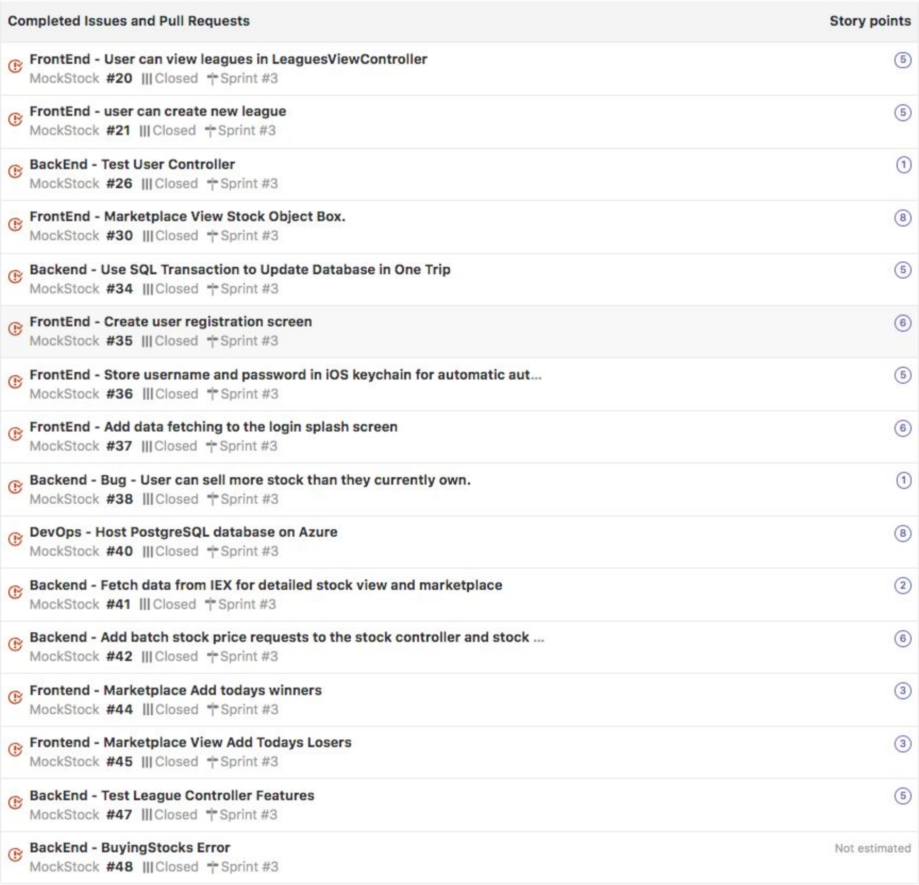
Sprint #3 Burndown Chart:



69 Total Story Points
69 Completed / 0 Remaining

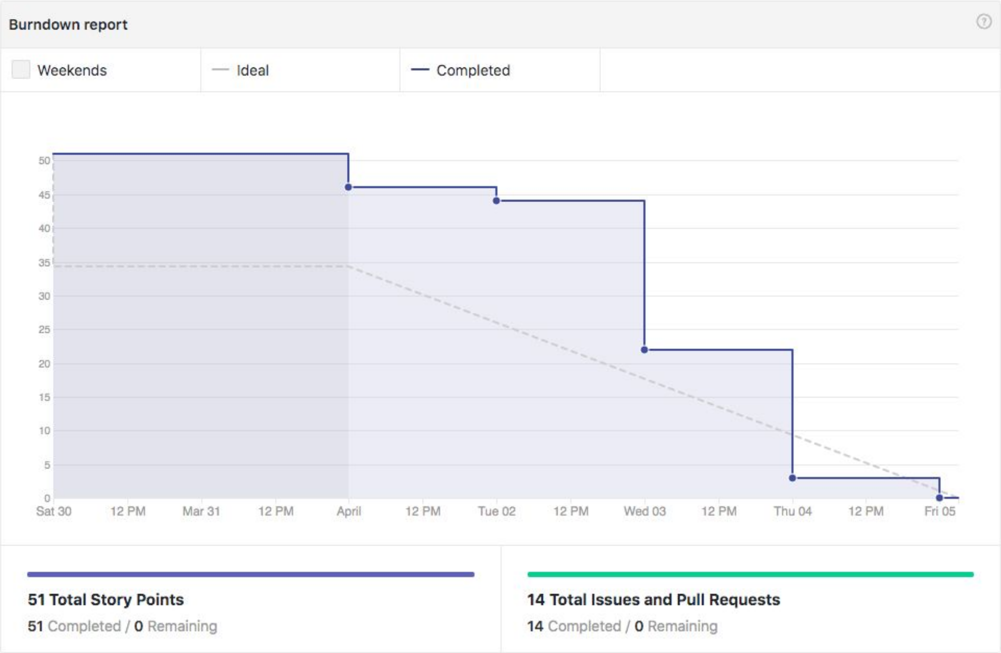
16 Total Issues and Pull Requests
16 Completed / 0 Remaining

Sprint #3 Product Backlog:



Completed Issues and Pull Requests	Story points
FrontEnd - User can view leagues in LeaguesViewController MockStock **#20** Closed Sprint #3	5
FrontEnd - user can create new league MockStock **#21** Closed Sprint #3	5
BackEnd - Test User Controller MockStock **#26** Closed Sprint #3	1
FrontEnd - Marketplace View Stock Object Box. MockStock **#30** Closed Sprint #3	8
Backend - Use SQL Transaction to Update Database in One Trip MockStock **#34** Closed Sprint #3	5
FrontEnd - Create user registration screen MockStock **#35** Closed Sprint #3	6
FrontEnd - Store username and password in iOS keychain for automatic aut... MockStock **#36** Closed Sprint #3	5
FrontEnd - Add data fetching to the login splash screen MockStock **#37** Closed Sprint #3	6
Backend - Bug - User can sell more stock than they currently own. MockStock **#38** Closed Sprint #3	1
DevOps - Host PostgreSQL database on Azure MockStock **#40** Closed Sprint #3	8
Backend - Fetch data from IEX for detailed stock view and marketplace MockStock **#41** Closed Sprint #3	2
Backend - Add batch stock price requests to the stock controller and stock ... MockStock **#42** Closed Sprint #3	6
Frontend - Marketplace Add todays winners MockStock **#44** Closed Sprint #3	3
Frontend - Marketplace View Add Todays Losers MockStock **#45** Closed Sprint #3	3
BackEnd - Test League Controller Features MockStock **#47** Closed Sprint #3	5
BackEnd - BuyingStocks Error MockStock **#48** Closed Sprint #3	Not estimated

Sprint #4 Burndown Chart:



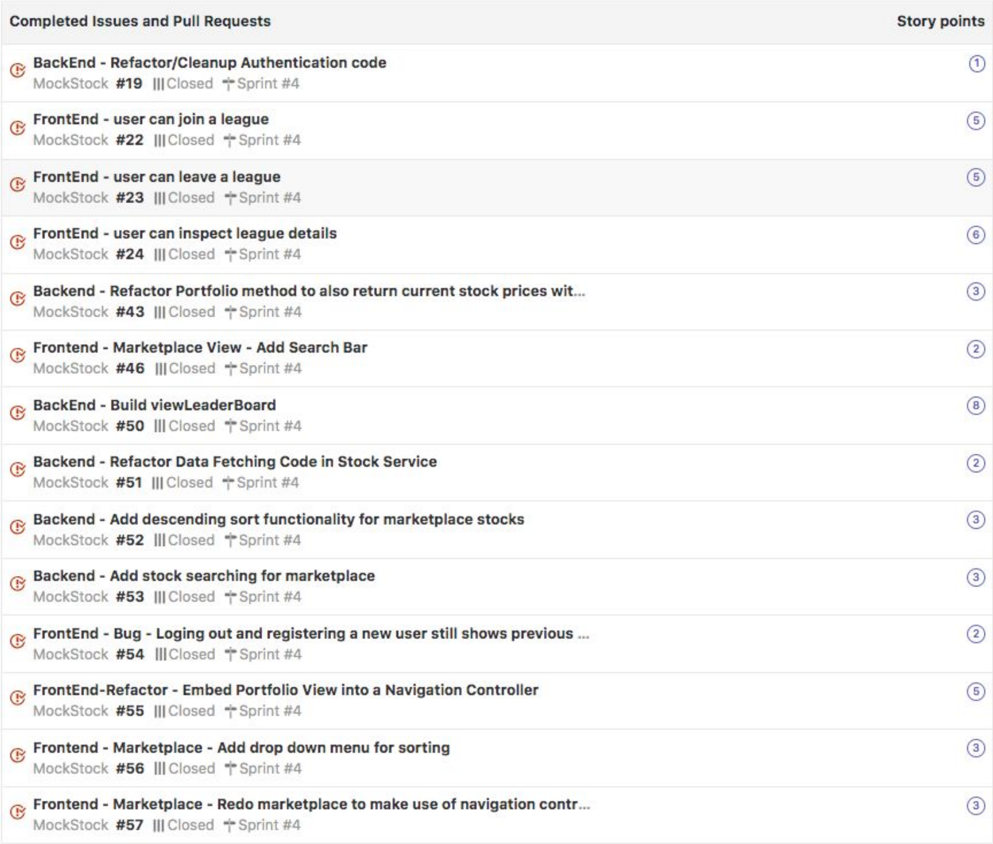
51 Total Story Points

51 Completed / **0** Remaining

14 Total Issues and Pull Requests

14 Completed / **0** Remaining

Sprint #4 Product Backlog:



Completed Issues and Pull Requests	Story points
BackEnd - Refactor/Cleanup Authentication code MockStock **#19** Closed Sprint #4	1
FrontEnd - user can join a league MockStock **#22** Closed Sprint #4	5
FrontEnd - user can leave a league MockStock **#23** Closed Sprint #4	5
FrontEnd - user can inspect league details MockStock **#24** Closed Sprint #4	6
Backend - Refactor Portfolio method to also return current stock prices wit... MockStock **#43** Closed Sprint #4	3
Frontend - Marketplace View - Add Search Bar MockStock **#46** Closed Sprint #4	2
BackEnd - Build viewLeaderBoard MockStock **#50** Closed Sprint #4	8
Backend - Refactor Data Fetching Code in Stock Service MockStock **#51** Closed Sprint #4	2
Backend - Add descending sort functionality for marketplace stocks MockStock **#52** Closed Sprint #4	3
Backend - Add stock searching for marketplace MockStock **#53** Closed Sprint #4	3
FrontEnd - Bug - Loging out and registering a new user still shows previous ... MockStock **#54** Closed Sprint #4	2
FrontEnd-Refactor - Embed Portfolio View into a Navigation Controller MockStock **#55** Closed Sprint #4	5
Frontend - Marketplace - Add drop down menu for sorting MockStock **#56** Closed Sprint #4	3
Frontend - Marketplace - Redo marketplace to make use of navigation contr... MockStock **#57** Closed Sprint #4	3

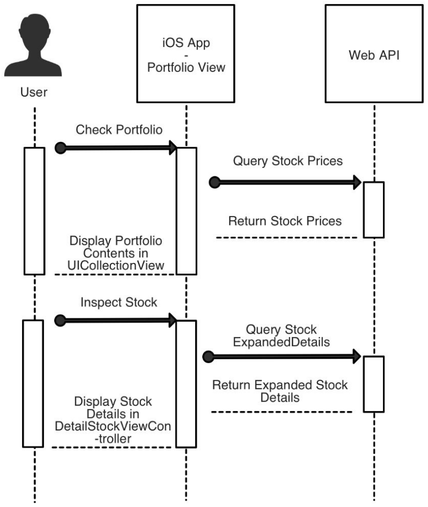
7. Subsystems

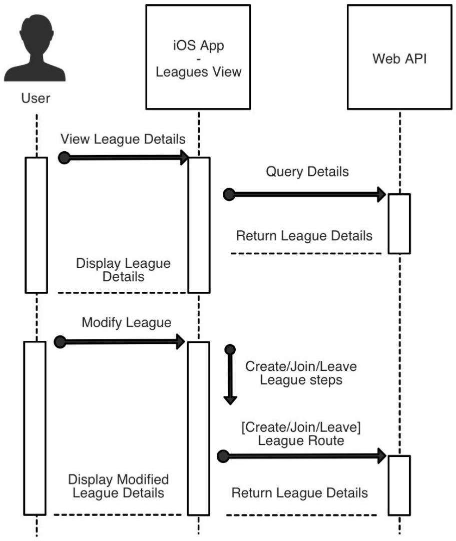
7.1 Subsystem 1 – Theodore Hecht III

Responsibilities: *Portfolio & Leagues frontend views + backend authentication*

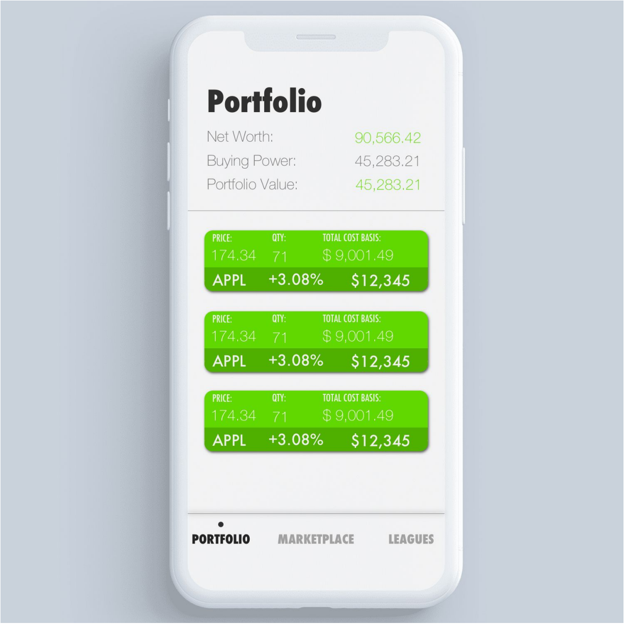
- Initial design and model
  - The Portfolio Screen displays the user's portfolio. It's main content is a UICollectionView with custom UICollectionView Cells to display portfolio data. The 'x' button lets you log out of the application.
  - The Leagues Screen displays all leagues in which the user has membership. This is also implemented with a UICollectionView. There is a detailed league screen that displays each member of the league sorted by income level. The + button lets you create or join a league.
  - The Registration Screen displays a simple login/register form, where the user can enter their username and password, and register or login to the service, when the appropriate button is pressed.
  - Each of these screens fetches data from the backend API when the screen appears. It decodes the response into one of the model objects, which implements the Decodable protocol, allowing JSON properties to be decoded into the object. This data is then used to populate the UIView widgets each view controller displays.

Sequence Diagrams:


User
iOS App
-
Portfolio View
Web API
Check Portfolio
Query Stock Prices
Return Stock Prices
Display Portfolio Contents in UICollectionView
Inspect Stock
Query Stock ExpandedDetails
Return Expanded Stock Details
Display Stock Details in DetailStockViewCon -troller



○ Initial UI Mockup:



Portfolio

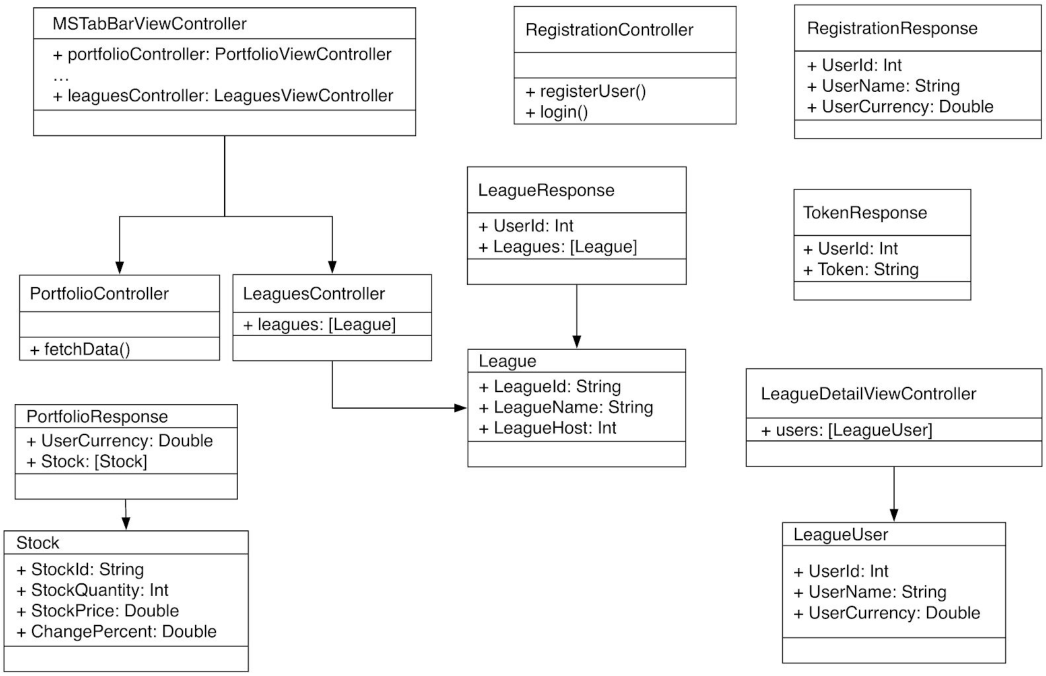
Net Worth: 90,566.42
Buying Power: 45,283.21
Portfolio Value: 45,283.21

PRICE: 174.34 QTY: 71 TOTAL COST BASIS: $ 9,001.49
APPL +3.08% $12,345

PRICE: 174.34 QTY: 71 TOTAL COST BASIS: $ 9,001.49
APPL +3.08% $12,345

PRICE: 174.34 QTY: 71 TOTAL COST BASIS: $ 9,001.49
APPL +3.08% $12,345

Class/UML diagrams for code-behind.

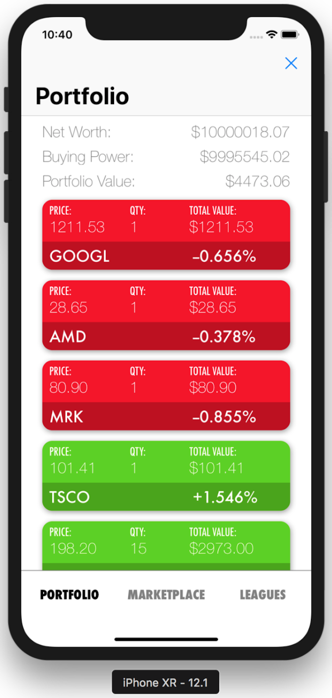


The app as a whole uses the MVC pattern, where the (not pictured) UIKit widgets are the views, which display information to the user, the ViewControllers are the controllers, which handle business logic and routing model data to the views, and the various json-decodable classes are the models.

The MSTabBarViewController handles displaying each major view subsystem (Portfolio, Marketplace, or Leagues controller.) Each ViewController has various UIKit widgets (not pictured), including labels, collection views, and collection view cells. It also has various model objects (displayed above) which implement the Decodable interface, which allows them to be easily deserialized from JSON, which is returned by our RESTful API.

- If refined (changed over the course of project)
    - The primary change from the initial frontend model was the inclusion of navigation controllers, which the primary view controllers are now embedded inside. (You can see these headers in the screenshots on the next page.) The reason for this refinement was to more easily transition from one view controller to an expanded details view controller, with smooth animations already built in. It also allows for a more consistent look and feel across the application. Unfortunately, this comes at the cost of customizability, since the navigation bar isn't as customizable as an entirely custom built solution. Fortunately, this design change didn't significantly alter the user interaction flow of the application.
    - Another change was the backend authentication mechanism. The new one, which I wrote, uses JWT token authentication, instead of "Basic authentication." The reason for this refinement was to prevent the need to check the database on every request for the user's password. With JWT tokens, this is avoidable. Instead, the username/password is checked once when a token is requested, and then the token is sent with future requests to the backend. This is advantageous for two main reasons: one, it increases performance by reducing the need for an extra call to the database on each request; two, it reduces the attack surface for compromising someone's account, because tokens expire, so a sniffed token has only a small window of time where it can be used (though we are using HTTPS, so this shouldn't be a common occurrence.) The disadvantage is if we were to revoke permissions for a user, they would still have those permissions until their token expires, since the permission claims are contained within the token itself.

- New Design:

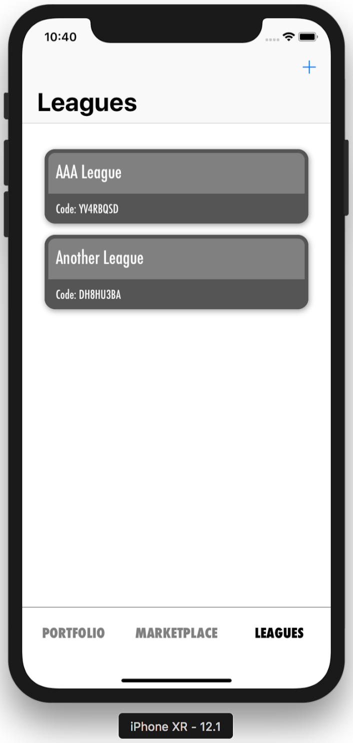


Portfolio

Net Worth:	$10000018.07
Buying Power:	$9995545.02
Portfolio Value:	$4473.06

PRICE:	QTY:	TOTAL VALUE:
1211.53	1	$1211.53
GOOGL		–0.656%
28.65	1	$28.65
AMD		–0.378%
80.90	1	$80.90
MRK		–0.855%
101.41	1	$101.41
TSCO		+1.546%
198.20	15	$2973.00

iPhone XR - 12.1

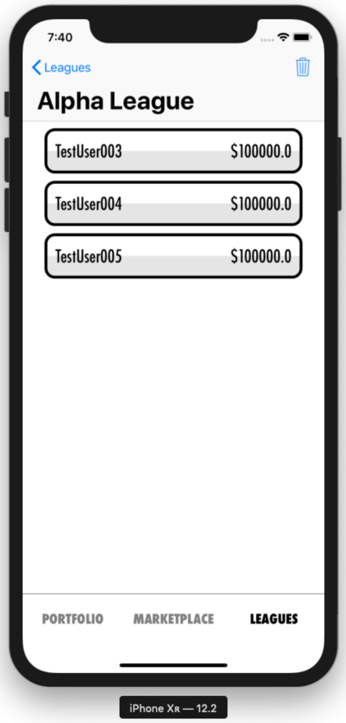


Leagues

AAA League
Code: YV4RBQSD

Another League
Code: DH8HU3BA

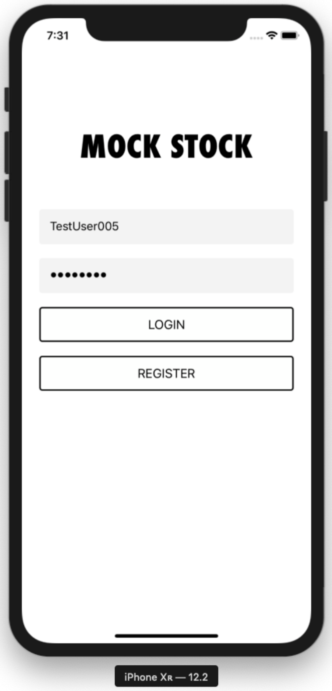
iPhone XR - 12.1



Alpha League

TestUser003	$100000.0
TestUser004	$100000.0
TestUser005	$100000.0

iPhone Xʀ — 12.2

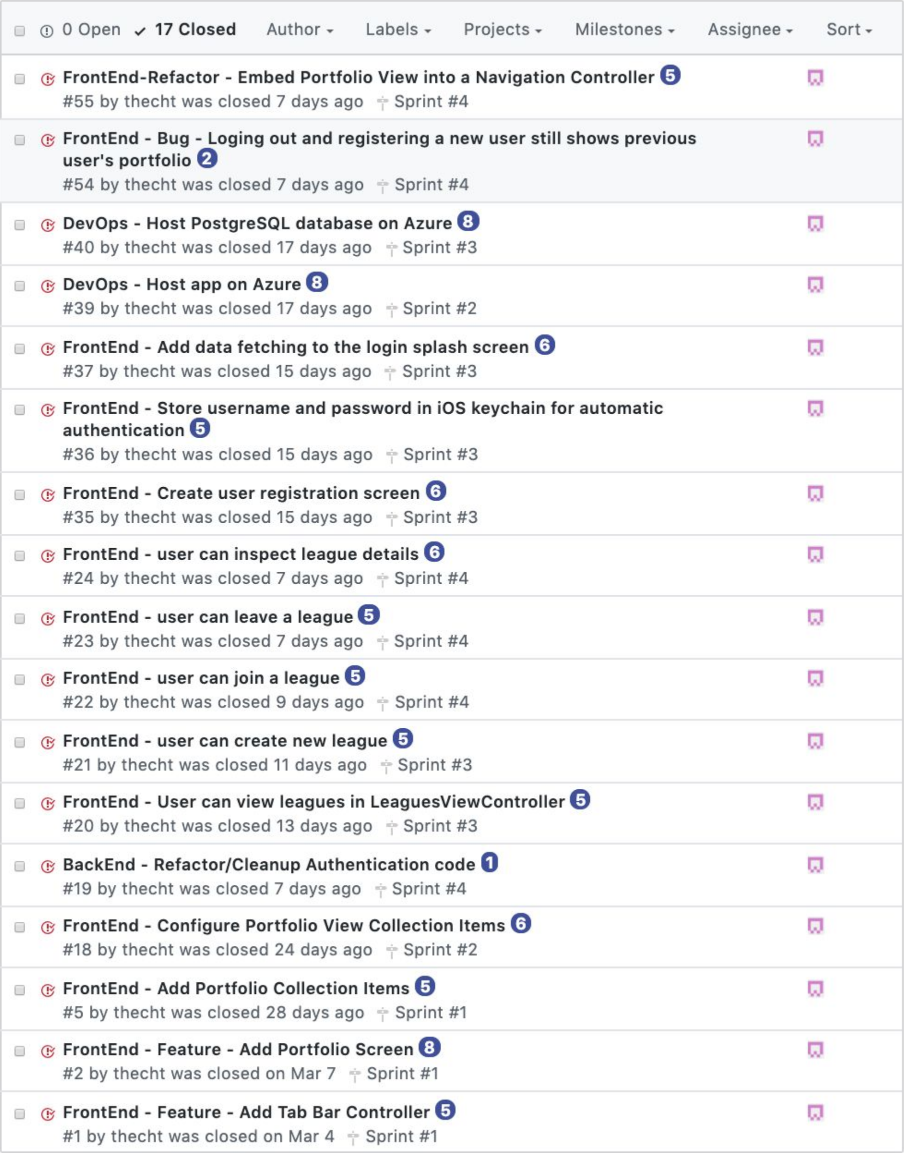


TestUser005

••••••••

iPhone Xʀ — 12.2

- Scrum Backlog (Product and Sprint - Link to Section 6)



FrontEnd-Refactor - Embed Portfolio View into a Navigation Controller 5
#55 by thecht was closed 7 days ago · Sprint #4

FrontEnd - Bug - Loging out and registering a new user still shows previous user's portfolio 2
#54 by thecht was closed 7 days ago · Sprint #4

DevOps - Host PostgreSQL database on Azure 8
#40 by thecht was closed 17 days ago · Sprint #3

DevOps - Host app on Azure 8
#39 by thecht was closed 17 days ago · Sprint #2

FrontEnd - Add data fetching to the login splash screen 6
#37 by thecht was closed 15 days ago · Sprint #3

FrontEnd - Store username and password in iOS keychain for automatic authentication 5
#36 by thecht was closed 15 days ago · Sprint #3

FrontEnd - Create user registration screen 6
#35 by thecht was closed 15 days ago · Sprint #3

FrontEnd - user can inspect league details 6
#24 by thecht was closed 7 days ago · Sprint #4

FrontEnd - user can leave a league 5
#23 by thecht was closed 7 days ago · Sprint #4

FrontEnd - user can join a league 5
#22 by thecht was closed 9 days ago · Sprint #4

FrontEnd - user can create new league 5
#21 by thecht was closed 11 days ago · Sprint #3

FrontEnd - User can view leagues in LeaguesViewController 5
#20 by thecht was closed 13 days ago · Sprint #3

BackEnd - Refactor/Cleanup Authentication code 1
#19 by thecht was closed 7 days ago · Sprint #4

FrontEnd - Configure Portfolio View Collection Items 6
#18 by thecht was closed 24 days ago · Sprint #2

FrontEnd - Add Portfolio Collection Items 5
#5 by thecht was closed 28 days ago · Sprint #1

FrontEnd - Feature - Add Portfolio Screen 8
#2 by thecht was closed on Mar 7 · Sprint #1

FrontEnd - Feature - Add Tab Bar Controller 5
#1 by thecht was closed on Mar 4 · Sprint #1

- Coding
    - The app was developed with the Swift 4 programming language, an object oriented programming language developed by Apple. This language was chosen because it is Apple’s preferred way of making native iOS apps.
    - We use CocoaPods as a dependency manager so that we could install third party libraries with ease.
    - We made extensive use of the MVC design pattern, as well as the delegation pattern, both of which are heavily used in iOS development.
- User training
    - How to Login or Register: At the Login/Registration screen, enter your username and password details into the boxes, and press either Login or Register.
    - How to View Portfolio: Click the Portfolio button on the bottom tab bar to access the portfolio view. Scroll up or down to see the contents. (A spinning activity indicator in the navigation bar signifies network activity.)
    - How to Inspect Owned Stock Details: In the portfolio view, click on a stock to bring up a detailed stock view to inspect stock details.
    - How to Logout: In the portfolio view, click the ‘x’ button in the top right corner in the navigation bar.
    - How to View Leagues: Press the Leagues button in the bottom tab bar to access the leagues view. Scroll up or down to see the leagues the logged in user belongs to.
    - How to View League Leaderboards: In the leagues view, click on a league to open the league details, which displays a list of all members of a league along with their total net worth (sorted in descending order).
    - How to Create League: In the leagues view, click on the ‘+’ button in the top right of the navigation bar. In the popup, press “Create League”, and then enter the name of the new league.
    - How to Join League: In the leagues view, click on the ‘+’ button in the top right of the navigation bar. In the popup, press “Join League”, and then enter the league code of the league you wish to join. (Note: codes are case sensitive.)

  - How to Leave League: In the league details view (which displays the league leaderboards), press the trashcan icon in the top right corner of the navigation bar. When prompted, press the option to leave the league. (Note: if you are the host/owner of the league, leaving the league deletes the league.)
- Testing
  - The front end application was tested using XCode and various iOS simulators. We used .NET Core’s open source kestrel web server for local testing with the backend, and then moved to a development staging environment in Azure to test the app as we moved to integrate the various pieces.
  - At each major integration, each of the actions in the above section (User training) were tested to see if we got the expected results. If we didn’t, finding the bug became a top priority.

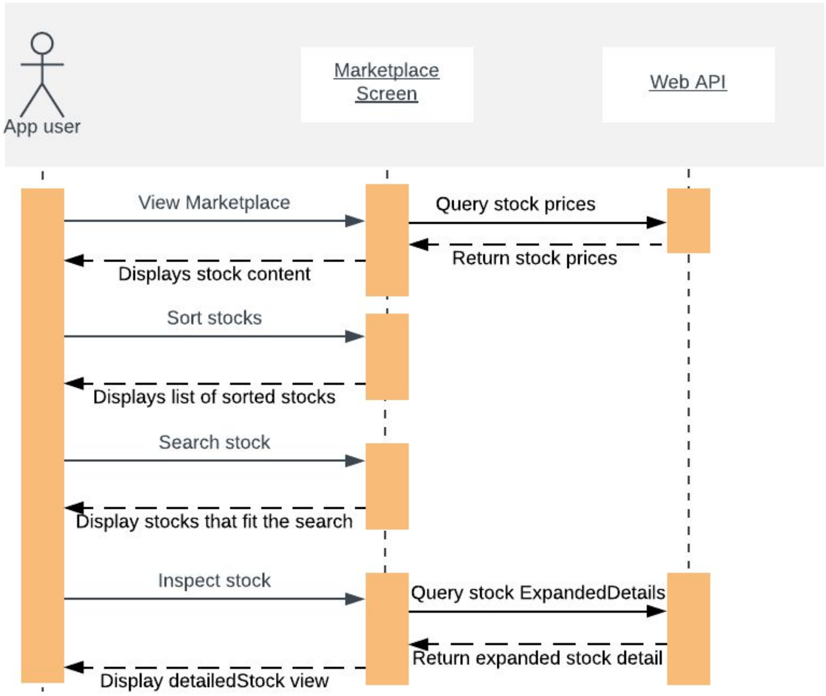
7.2 Subsystem 2 – Luke Orr

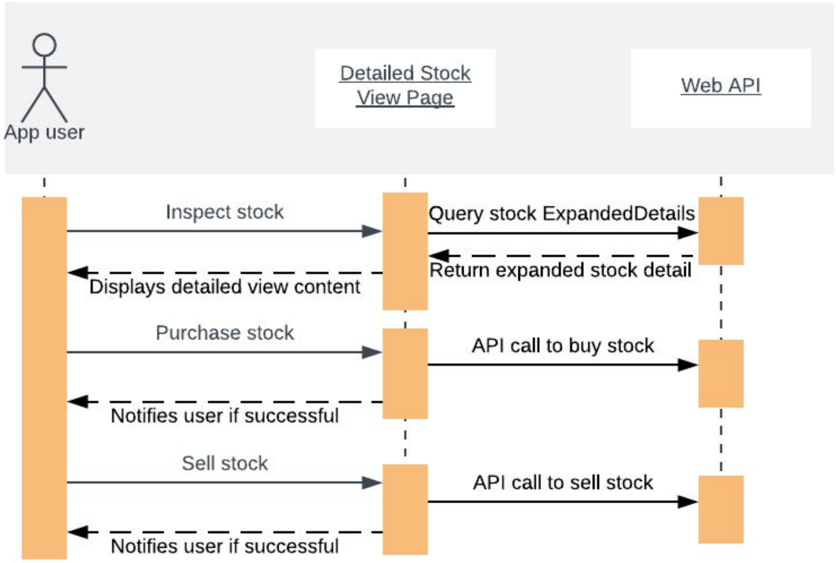
Responsibilities: Marketplace, Stock Detail, Graph, and Transaction frontend views

Initial design and model

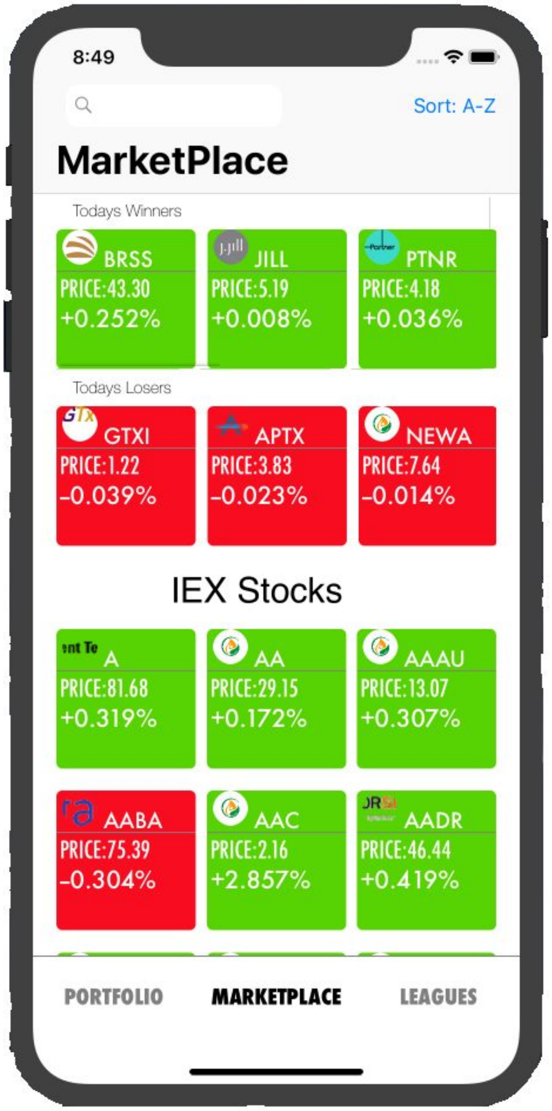
- The Marketplace screen displays three separate lists of stocks each its own uicollectionview. One list is the “Today’s Winners” list which is a collection of stocks pulled from the backend API. Another list is the “Today’s Losers list which is also a collection of stocks pulled from the backend API. The winners and losers sections are displayed in a horizontal uicollectionview that is inside of the main uicollectionview. The last list is the main marketplace list pulled from the backend API. The marketplace allows for users to search for either a specific stock or for stocks beginning with the letters that the user typed into the search field. This not only allows for users to find the stock that they want, but also allows users to refine the list of stocks displayed to them. The last feature of the marketplace screen is the sort feature. The sort button allows users to sort the third list of stocks by either a-z or z-a.
- The Detailed View screen has three main features to it. One is that the screen displays more information about the stock that the user selected from either the portfolio or marketplace screens. The second feature is that users can buy or sell stocks from this screen by clicking either the buy or sell button. The last feature is that the detailed view screen also contains a graphical representation of the stocks price history. The graph can be changed by selecting one of the four buttons located below the graph view. This allows users to see the stocks price history in an easy to understand way. The four graph options are one month, three months, six months, and one year. Once a user selects either the buy or sell button, a subview will pop up which is the transaction subview. This subview is where the users will type in the amount of the stock they wish to either buy or sell. Upon success the system notifies the user with a popup.

- Sequence Diagrams


App user
Marketplace Screen
Web API
View Marketplace
Query stock prices
Return stock prices
Displays stock content
Sort stocks
Displays list of sorted stocks
Search stock
Display stocks that fit the search
Inspect stock
Query stock ExpandedDetails
Return expanded stock detail
Display detailedStock view


App user
Detailed Stock View Page
Web API
Inspect stock
Query stock ExpandedDetails
Return expanded stock detail
Displays detailed view content
Purchase stock
API call to buy stock
Notifies user if successful
Sell stock
API call to sell stock
Notifies user if successful

- ○ UI Designs



MarketPlace

Todays Winners

BRSS
PRICE:43.30
+0.252%

JILL
PRICE:5.19
+0.008%

PTNR
PRICE:4.18
+0.036%

Todays Losers

GTXI
PRICE:1.22
-0.039%

APTX
PRICE:3.83
-0.023%

NEWA
PRICE:7.64
-0.014%

IEX Stocks

A
PRICE:81.68
+0.319%

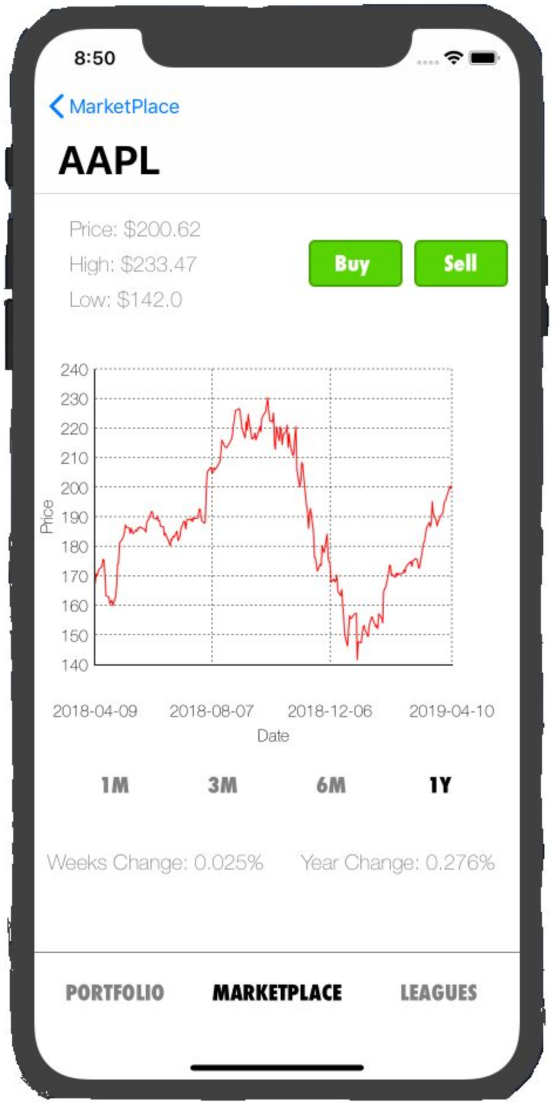
AA
PRICE:29.15
+0.172%

AAAU
PRICE:13.07
+0.307%

AABA
PRICE:75.39
-0.304%

AAC
PRICE:2.16
+2.857%

AADR
PRICE:46.44
+0.419%



AAPL

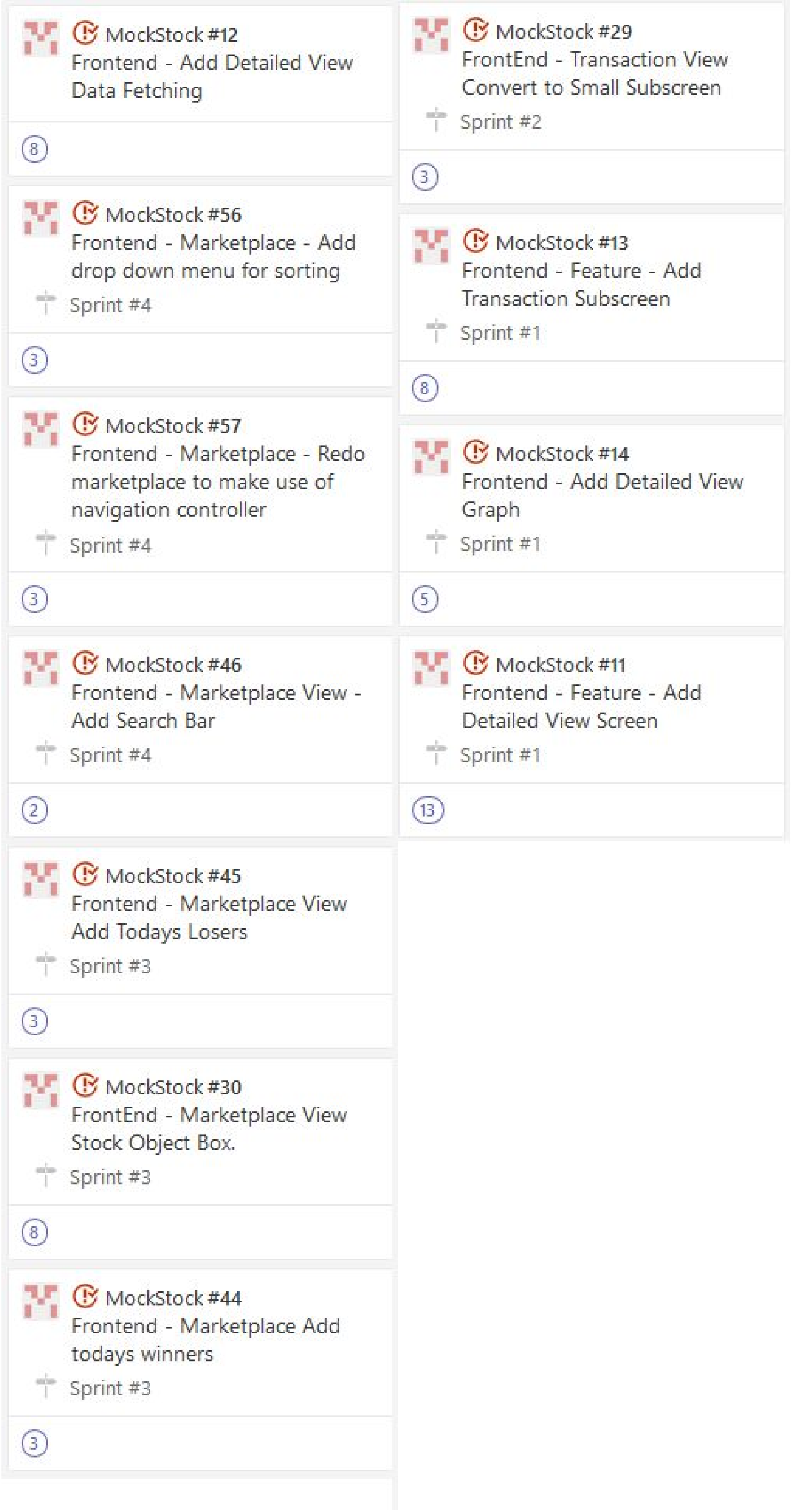
Price: $200.62
High: $233.47
Low: $142.0

Weeks Change: 0.025%
Year Change: 0.276%

Refined Systems

- Marketplace
    - The marketplace view went through a couple changes. Originally the marketplace view was going to be a single view of a list of stocks. The user would be able to sort the stocks based off symbol and price. However there was no way for us to be able to add a sort by price given what was available to us from the IEX API. After discussing this issue, we decided to replace the sort by price function with two separate lists of stocks called “Today’s Winners” and “Today's Losers”. The winners and losers stocks are displayed in a horizontal scroll view that is embedded in the main marketplace view. The pros of this change is that it makes the marketplace view have an app market look. The users will be able to quickly see “featured” stocks that they may not have seen with a simple sort by price feature. A con for this change is that there is no way for a user to be able to easily see the most and least expensive stocks.
- Detailed View
    - Our initial design for the detailed view was that users would be able to purchase and sell stocks directly from that view. However after initially designing the detailed view, it looked very cluttered. We then decided to move the transaction functions over to a seperate view called the transaction view. This way once users click on the buy or sell button contained in the detailed view, a separate sub screen will pop up that allows the users to purchase/sell the stock. A pro for this change is that it made the detailed view screen less cluttered which allowed us to make the graph image larger and more legible. A con to this change is that now users have to go through an additional screen in order to buy or sell the stock.

Scrum Backlog (Product and Sprint - Link to Section 6)



MockStock #12
Frontend - Add Detailed View Data Fetching
8

MockStock #56
Frontend - Marketplace - Add drop down menu for sorting
Sprint #4
3

MockStock #57
Frontend - Marketplace - Redo marketplace to make use of navigation controller
Sprint #4
3

MockStock #46
Frontend - Marketplace View - Add Search Bar
Sprint #4
2

MockStock #45
Frontend - Marketplace View Add Todays Losers
Sprint #3
3

MockStock #30
FrontEnd - Marketplace View Stock Object Box.
Sprint #3
8

MockStock #44
Frontend - Marketplace Add todays winners
Sprint #3
3

MockStock #29
FrontEnd - Transaction View Convert to Small Subscreen
Sprint #2
3

MockStock #13
Frontend - Feature - Add Transaction Subscreen
Sprint #1
8

MockStock #14
Frontend - Add Detailed View Graph
Sprint #1
5

MockStock #11
Frontend - Feature - Add Detailed View Screen
Sprint #1
13

Coding

- The frontend was designed using the swift programming language which is an object oriented language.

User training

- The use of the mock stock application would not require much training on the part of the user. We designed the front end UI to be simple and easy to understand. One of our goals was to make it so that users would be able to easily understand and use the mock stock application. The most complicated thing for the users involving my subsystems would be knowing that they can click on the top right button in the marketplace to change the sort.

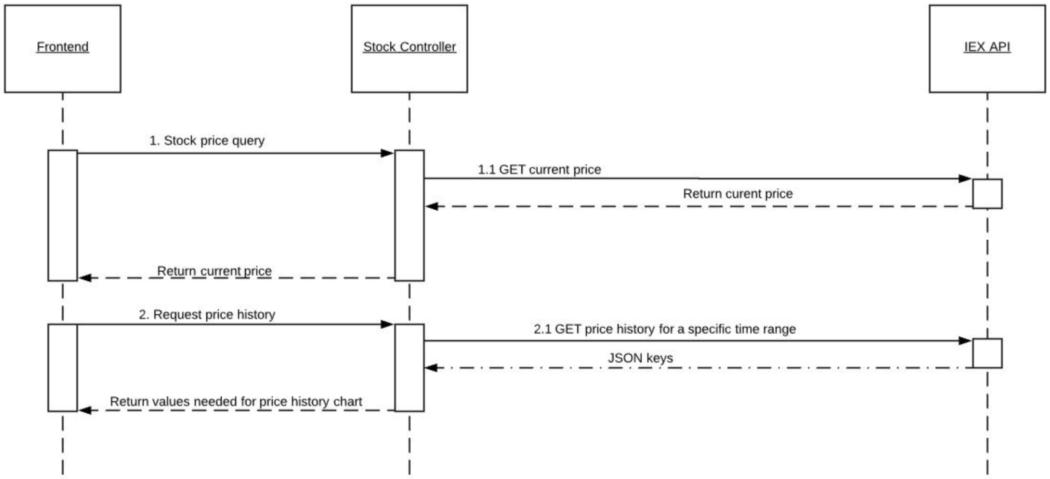
Testing

- The frontend subsystems were mostly tested using xcode and an iphone simulator. The api calls were tested using postman to see if the data displayed by the frontend systems were accurate. Each subsystem was tested thoroughly using the above methods.

7.3 Subsystem 3 – Jonathan Langston

Responsibilities:*Stock & Transaction backend functionality, Communication with IEX API*

- Initial design and model
    - At first there was no Transaction controller, only the stock controller to handle all kinds of stock related functions and purchase functions. The controller has methods to buy stocks, sell stocks, get a price query, and get detailed information like price history to create a graph with.
    - Each controller has a corresponding service (i.e. Stock Controller and Stock Service) in order to separate the business logic.
    - Interaction with IEX API:

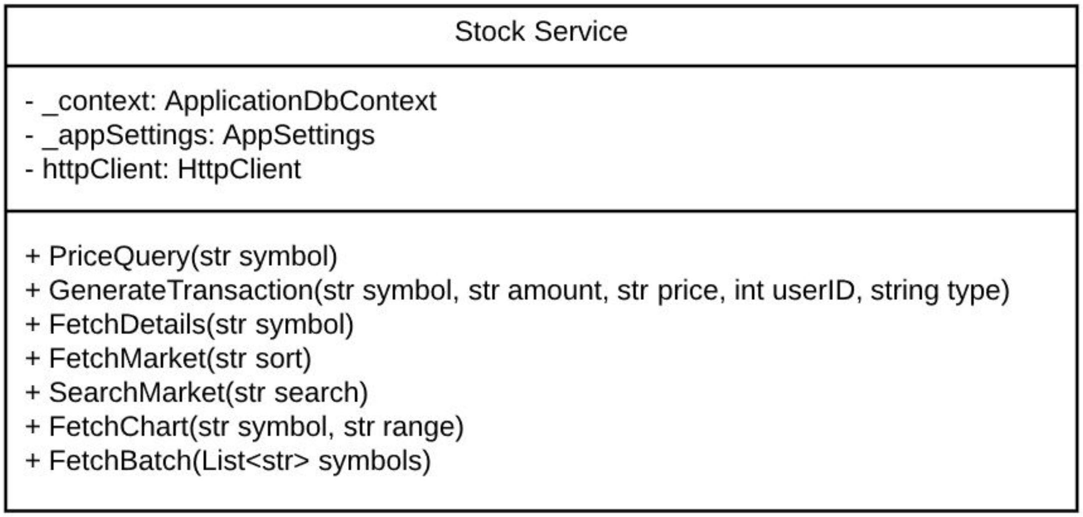


- Data dictionary

Name	Data Type	Description
StockID	integer	The stock symbol. Also used as a composite key for tracking owned stocks.
StockQuantity	integer	The number of stocks owned by a user for a specific company.
Price	double	Price paid or earned from buying/selling a stock.
TransactionID	integer	Used as an index for the transactions in the database.

TransactionDate	DateTime	Time at which the exchange occurred.
TransactionType	string	Determine if the stocks were bought or sold.

- Refined design
  - Eventually a Transaction controller needed to be added for functions like getting a transaction history for a user or any future functions that could be added after development is finished that relate specifically to transactions. This change was made since it would not make much sense to have transaction related functions in a controller meant to be used for stock related actions. It also improves future refinement of the app if any additional transaction functions are added in post-development patches.
  - Stock Service:

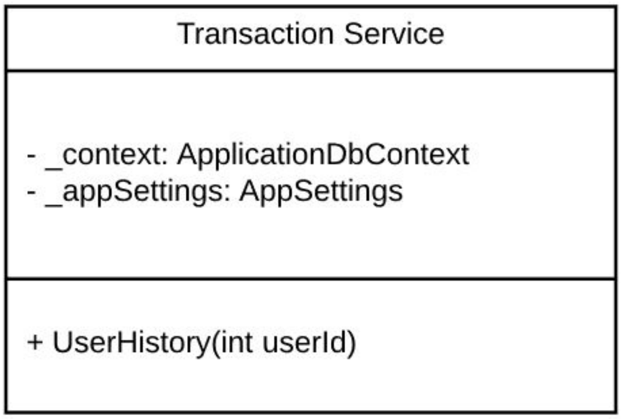


Stock Service

- _context: ApplicationDbContext
- _appSettings: AppSettings
- httpClient: HttpClient

+ PriceQuery(str symbol)
+ GenerateTransaction(str symbol, str amount, str price, int userID, string type)
+ FetchDetails(str symbol)
+ FetchMarket(str sort)
+ SearchMarket(str search)
+ FetchChart(str symbol, str range)
+ FetchBatch(List<str> symbols)

  - Transaction Service:

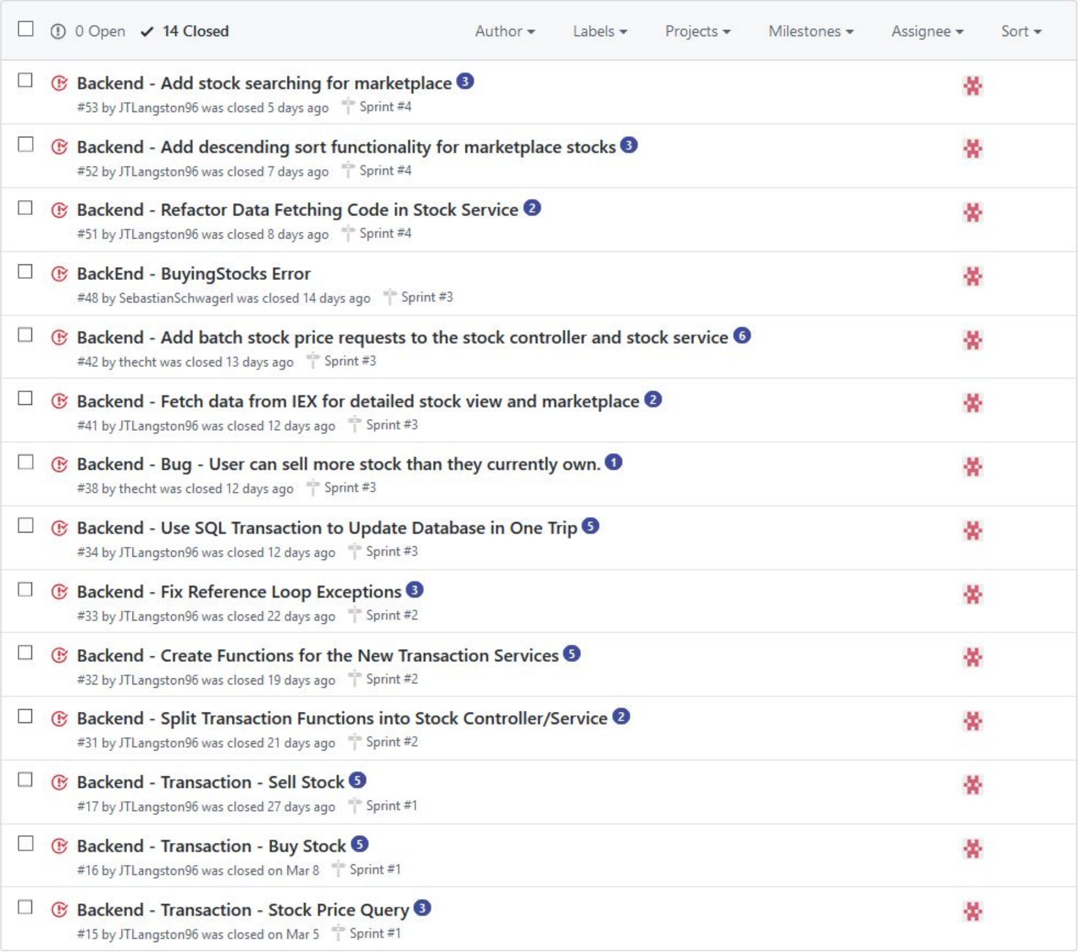


Transaction Service

- _context: ApplicationDbContext
- _appSettings: AppSettings

+ UserHistory(int userId)

- Scrum Backlog (Product and Sprint - Link to Section 6)



□ Backend - Add stock searching for marketplace 3
#53 by JTLangston96 was closed 5 days ago Sprint #4

□ Backend - Add descending sort functionality for marketplace stocks 3
#52 by JTLangston96 was closed 7 days ago Sprint #4

□ Backend - Refactor Data Fetching Code in Stock Service 2
#51 by JTLangston96 was closed 8 days ago Sprint #4

□ BackEnd - BuyingStocks Error
#48 by SebastianSchwagerl was closed 14 days ago Sprint #3

□ Backend - Add batch stock price requests to the stock controller and stock service 6
#42 by thecht was closed 13 days ago Sprint #3

□ Backend - Fetch data from IEX for detailed stock view and marketplace 2
#41 by JTLangston96 was closed 12 days ago Sprint #3

□ Backend - Bug - User can sell more stock than they currently own. 1
#38 by thecht was closed 12 days ago Sprint #3

□ Backend - Use SQL Transaction to Update Database in One Trip 5
#34 by JTLangston96 was closed 12 days ago Sprint #3

□ Backend - Fix Reference Loop Exceptions 3
#33 by JTLangston96 was closed 22 days ago Sprint #2

□ Backend - Create Functions for the New Transaction Services 5
#32 by JTLangston96 was closed 19 days ago Sprint #2

□ Backend - Split Transaction Functions into Stock Controller/Service 2
#31 by JTLangston96 was closed 21 days ago Sprint #2

□ Backend - Transaction - Sell Stock 5
#17 by JTLangston96 was closed 27 days ago Sprint #1

□ Backend - Transaction - Buy Stock 5
#16 by JTLangston96 was closed on Mar 8 Sprint #1

□ Backend - Transaction - Stock Price Query 3
#15 by JTLangston96 was closed on Mar 5 Sprint #1

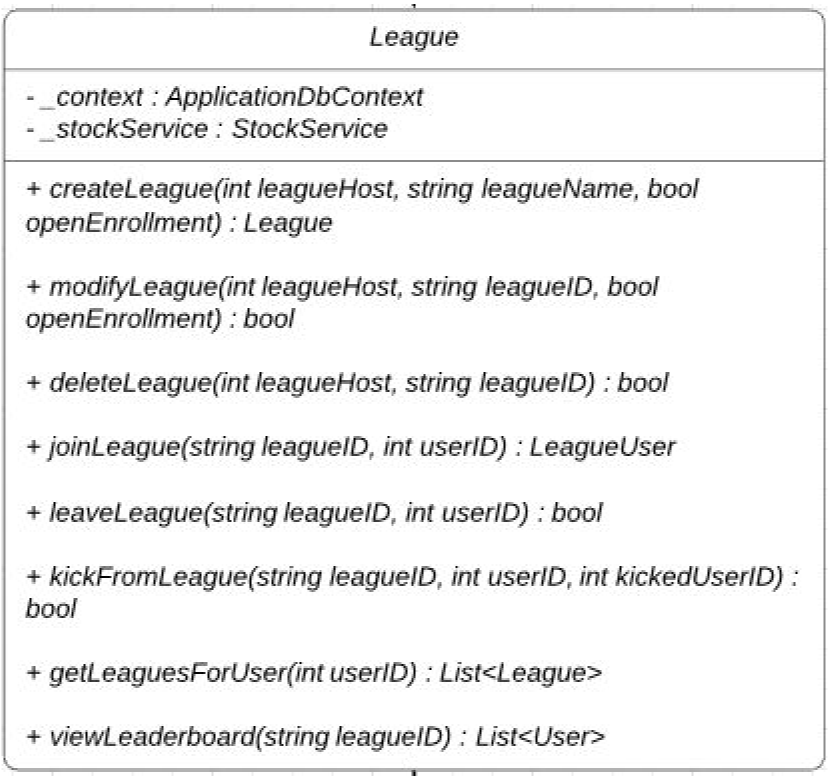
- Coding
  - The Stock and Transaction parts of the backend are written in C# and uses the .NET Core framework. Entity Framework Core is used to work with the database and make changes to it along with making changes to created objects being sent to the frontend.
  - Since C# was the language of choice, a more object-oriented approach was taken when building the backend to reduce the amount of repeated coding that was needed. Entity Framework Core helped accomplished this with their entity models.
- Testing
  - Once the code was written, it was tested using Postman to send http requests locally and using pgAdmin to handle the local database that was used for the testing environment.

7.4 Subsystem 4 – Sebastian Schwagerl

Responsibilities: *Portfolio, Leagues, and User backend methods.*

- Initial design and model
  - Initially, we planned for 5 Controllers and Services (User, League, Company, Stock, and Achievements)
  - Portfolio was then added to handle displaying data for a screen of the same name, while company and modifyingFunds from User was placed within the stock controller.
  - The services were intended to have global variables, though the controllers passed in all the values they needed by being auto-wired by .NET Core's dependency injection system, which handles injection dependencies into constructors when configured in the app's startup class.

  - League Service:



League

- _context : ApplicationDbContext
- _stockService : StockService

+ createLeague(int leagueHost, string leagueName, bool openEnrollment) : League

+ modifyLeague(int leagueHost, string leagueID, bool openEnrollment) : bool

+ deleteLeague(int leagueHost, string leagueID) : bool

+ joinLeague(string leagueID, int userID) : LeagueUser

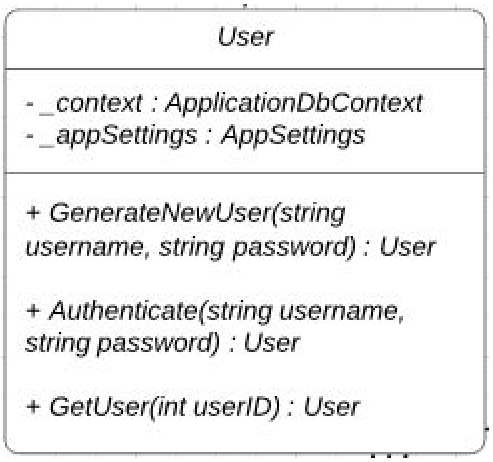
+ leaveLeague(string leagueID, int userID) : bool

+ kickFromLeague(string leagueID, int userID, int kickedUserID) : bool

+ getLeaguesForUser(int userID) : List<League>

+ viewLeaderboard(string leagueID) : List<User>

- User Service:



User

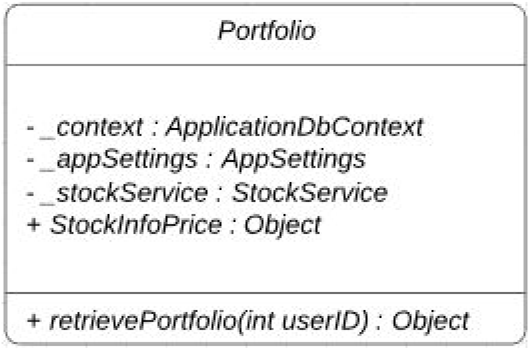
- _context : ApplicationDbContext
- _appSettings : AppSettings

+ GenerateNewUser(string username, string password) : User

+ Authenticate(string username, string password) : User

+ GetUser(int userID) : User

- Portfolio Service:



Portfolio

- _context : ApplicationDbContext
- _appSettings : AppSettings
- _stockService : StockService
+ StockInfoPrice : Object

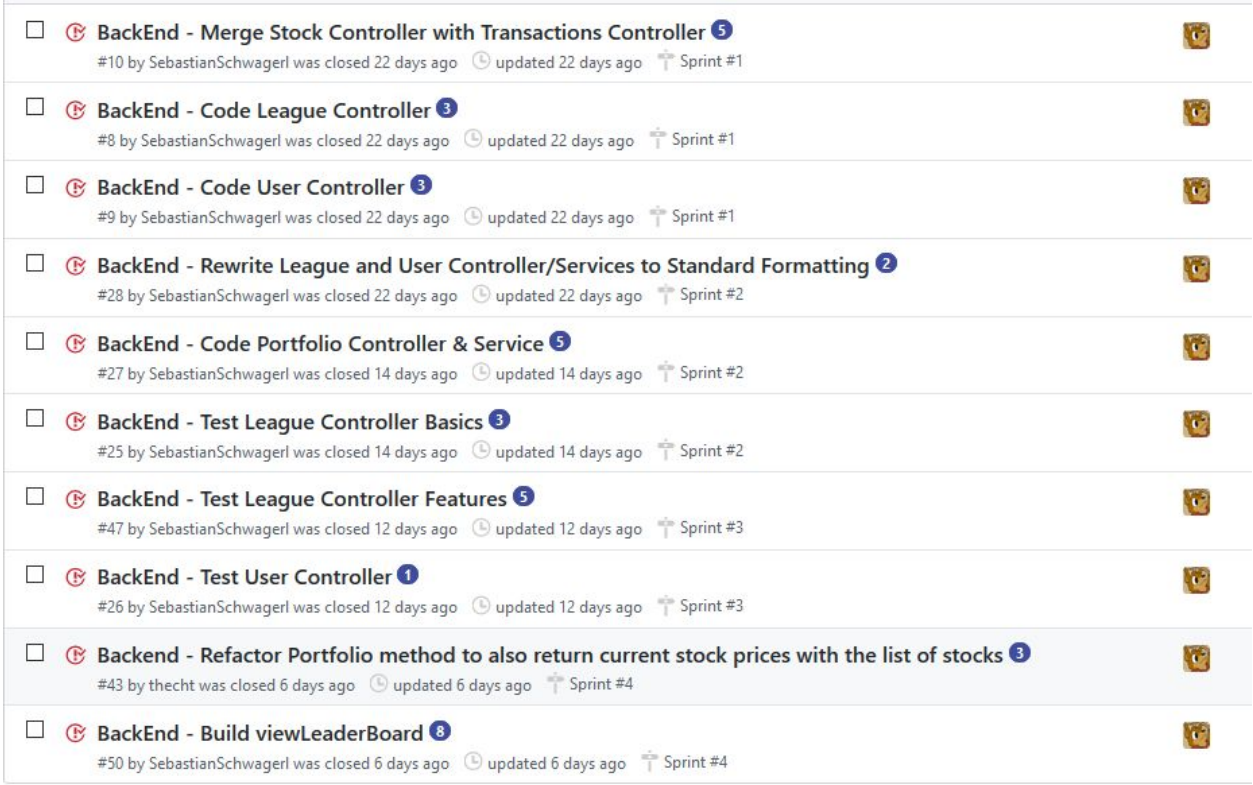
+ retrievePortfolio(int userID) : Object

- Data dictionary

Name	Data Type	Description
user	User	Contains the entirety of user data.
userID	integer	Used for tracking the user with one value.
userName	string	The entered username. Paired with password to access.
userPassword	string	Will be hashed before being stored. Entered password is compared to stored hashed password.
userCurrency	double	The current unused funds on a user's account.
league	League	An entry for a league. Contains leagueID, Host, Name, CreationDate, and Enrollment type.

leagueUser	LeagueUser	A user within a league. Stores each of their IDs as well as their privilege level, though unused.
leagueID	integer	Used for tracking league.
leagueName	string	Name assigned to league upon creation.
leagueDate	DateTime	Date and time league was created. For use in record keeping, or potential deadlines.
stockID	integer	Used for tracking companies and stocks.
stockQty	integer	The number of stocks owned by a user for a specific company.
stockPrice	double	Price paid or earned from buying/selling a stock.
changePercent	decimal	The percentage change of a stock over a span of time.
stockInfoPrice	StockInfoPrice[]	An array of all stocks for a user, including quantity owned, price, and percent change.
leaderBoard	List<User>	An unsorted list of users with a known net worth.
sortedLeaderBoard	List<User>	An ordered list of users, sorted by their net worth.

- Refinements
  - Most of the methods in the service are self-sufficient and do not rely on any global values outside of an ApplicationDBContext object and an object connecting to StockService.
  - Portfolio also became its own Controller and Service, split apart from User.
  - The CompanyController and Service were removed from the project as they were handled instead by the API in the Stock methods.
  - Achievements were not implemented due to time constraints for the frontend.
- Scrum Backlog



□ BackEnd - Merge Stock Controller with Transactions Controller 5
#10 by SebastianSchwagerl was closed 22 days ago updated 22 days ago Sprint #1

□ BackEnd - Code League Controller 3
#8 by SebastianSchwagerl was closed 22 days ago updated 22 days ago Sprint #1

□ BackEnd - Code User Controller 3
#9 by SebastianSchwagerl was closed 22 days ago updated 22 days ago Sprint #1

□ BackEnd - Rewrite League and User Controller/Services to Standard Formatting 2
#28 by SebastianSchwagerl was closed 22 days ago updated 22 days ago Sprint #2

□ BackEnd - Code Portfolio Controller & Service 5
#27 by SebastianSchwagerl was closed 14 days ago updated 14 days ago Sprint #2

□ BackEnd - Test League Controller Basics 3
#25 by SebastianSchwagerl was closed 14 days ago updated 14 days ago Sprint #2

□ BackEnd - Test League Controller Features 5
#47 by SebastianSchwagerl was closed 12 days ago updated 12 days ago Sprint #3

□ BackEnd - Test User Controller 1
#26 by SebastianSchwagerl was closed 12 days ago updated 12 days ago Sprint #3

□ Backend - Refactor Portfolio method to also return current stock prices with the list of stocks 3
#43 by thecht was closed 6 days ago updated 6 days ago Sprint #4

□ BackEnd - Build viewLeaderBoard 8
#50 by SebastianSchwagerl was closed 6 days ago updated 6 days ago Sprint #4

- Coding
  - Language: C#, with Linq database connections using Visual Studio Code.
  - Using C#, we went with an Object Oriented approach to programming. Doing this, we were able to easily keep everything in order, and along the lines of our EntityModels method, which tracked the parts of every object.
  - Every controller method passes back a serialized object version of what was returned from their service, so it always returns a string.
- User training
  - As this is the backend; user training is not required.
- Testing
  - Testing was handled through Postman and a Postgres Database using PGAdmin 4. Using these, I was able to perform tests without any frontend assistance.

8. Complete System – *Group responsibility*

- Final software/hardware product
- Source code and user manual – screenshots as needed - Technical report
    - Github Link
- Evaluation by client and instructor
- Team Member Descriptions

This is just a guide, and use it to create/improve your report. Feel free to add sections. You are responsible for your own subsystem/s, not other members. You have to contribute to the team's goals and objectives, and develop your subsystem/s, write your documents and slides.

Things to Consider:

What to do if player has dropped to very low $ in the Stock game? Give chance to reset game? Have them deal with it like real life?

- That's a good question. We certainly don’t want them to keep making new accounts. Perhaps we have weekly achievements & milestones that are completable even with low $, which will give them more virtual currency. Perhaps some virtual currency can be given each day they log in, to incentivize them using the app often. We can come up with a list of ways to address this issue in the next week or two as we plan the app.

Shall we have a chart of stock prices available for every company, if possible to import?

- We might could keep up-to-date data on a certain number of high profile companies (like those in the S&P 500) from whatever financial API we use, and record those regularly. If a user searches for a specific ticker name not in the list, we can make another API call to grab that data in real time (or if they want to see the historical price of the stock, to display in a chart, perhaps there is a way to grab that from the financial API. Or maybe there are open databases out there with historical stock price information? In that case we could import it and store in our database.)

Complete Before Progress Report #2

1 - DESIGN:

Subsystems:

- ❏ Use-case, sequence, & UML Diagrams w/ descriptions if necessary. **(Everyone)**
- ~~❏ Subsystem Communication + Overall System Diagrams. **(Tyler)**~~
- ~~❏ API Route list (GET, POST, etc.) **(Trey)**~~
- ❏ ER Model **(Sebastian)**

2 - ANALYSIS:

- ~~❏ Backend Systems Analysis **(Trey)**~~
- ❏ Frontend Systems Analysis **(Luke)**
- ❏ Data Dictionary **(Sebastian)**
- ❏ Process Models **(Luke)**
- ~~❏ Algorithm Analysis - Search & Sort. **(Luke & Trey)**~~

3 - Update 1-3 on Doc (Low Priority):

- ❏ In the introduction, remove the tech information, replace with general functionality information.
- ❏ In the Project Requirements, go into more detail for “System.”
- ❏ In the Project Specifications, explain in more detail what each chosen piece of tech actually does for us and why (briefly) we chose it.

By Thursday:

1. UI Designs done
2. Product Backlog done
3. User + League controllers & services
4. Stock controller

Product Backlog :

FrontEnd:

- ❏ Create UI Designs
    - ❏ Portfolio Screen
    - ❏ Marketplace Screen
    - ❏ Leagues Screen
    - ❏ Detailed Stock View Screen
- ❏ Search for stocks in the Marketplace
- ❏ Leagues (shows a list of leagues.)
    - ❏ Create or Join League (popup).
    - ❏ Inspect League (tap league -> popup).
    - ❏ Leave League (in inspector popup)
    - ❏ Disband League (in inspector popup if owner.)

BackEnd:

- ❏ Add Authentication/Authorization
- ❏ Add a Controller method for every necessary API route. (Add Services to perform the business logic / work).
    - ❏ LeagueController
        - ❏ Create league -- allow user to create a league - 1
        - ❏ Join league -- allow a user to join an already created league
        - ❏ View leagues -- displays list of open leagues for user.
        - ❏ View leaderboard -- display sorted list of users within league.
    - ❏ TransactionController
        - ❏ Buy stock -- allow user to purchase a stock
        - ❏ Sell stock -- allow user to sell an owned stock
            - ❏ Update stock -- handles actions that add to or remove from existing stock quantity.
            - ❏ Delete stock -- if the stock qty reaches 0, it will be removed.

  - UsersController
    - Create user -- adds user and credentials to database.
    - Modify funds -- change the available currency of the user.
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