PROJECT Design Documentation

Team Information

- Team name: TEAMNAME
- Team members
  - Bin Qiu
  - Truong Anh Tuan Hoang
  - Alex Johannesson
  - Michael Merlino

Executive Summary

Webcheckers application allows players to play checkers via the Java Spark framework. A player must sign in to the application to play with another player. Once a game is started, the application supports a drag and drop game experience for making moves.

Purpose

Users are allowed to play American checkers with other users that are signed in.

Glossary and Acronyms

Term	Definition
VO	Value Object

Requirements

Players must be able to sign in to the application in order to start a game of checkers against other signed in players. Using drag and drop interface, players are able to move their pieces to capture opponent pieces to win. If a player's piece reaches the opponent's end of the board, that piece will become a king piece. The king piece is able to move to either side of the board. Players also have the option to resign when they do not want to continue the game.

Definition of MVP

Users are able to sign in, start a game by challenging an opponent, and play the game using American Checker rules.

MVP Features

- Sign In and Out
  - As a Player, I want to sign in so that I can play a game of checkers.
  - As a Player, I want to sign out so that I can leave the Webcheckers application.
- Start Game
  - As a Player, I want to start a game so that I can play checkers with opponent.
- Simple Move
  - As a Player, I want to perform a simple move so that I can advance my pieces in a game of checkers.
- Single Jump Move
  - As a Player, I want to make a single jump move so that I can capture my opponent's piece.
- Multiple Jump Move
  - As a Player, I want to make a multiple jump move so that I can capture several of my opponent's pieces in one turn.

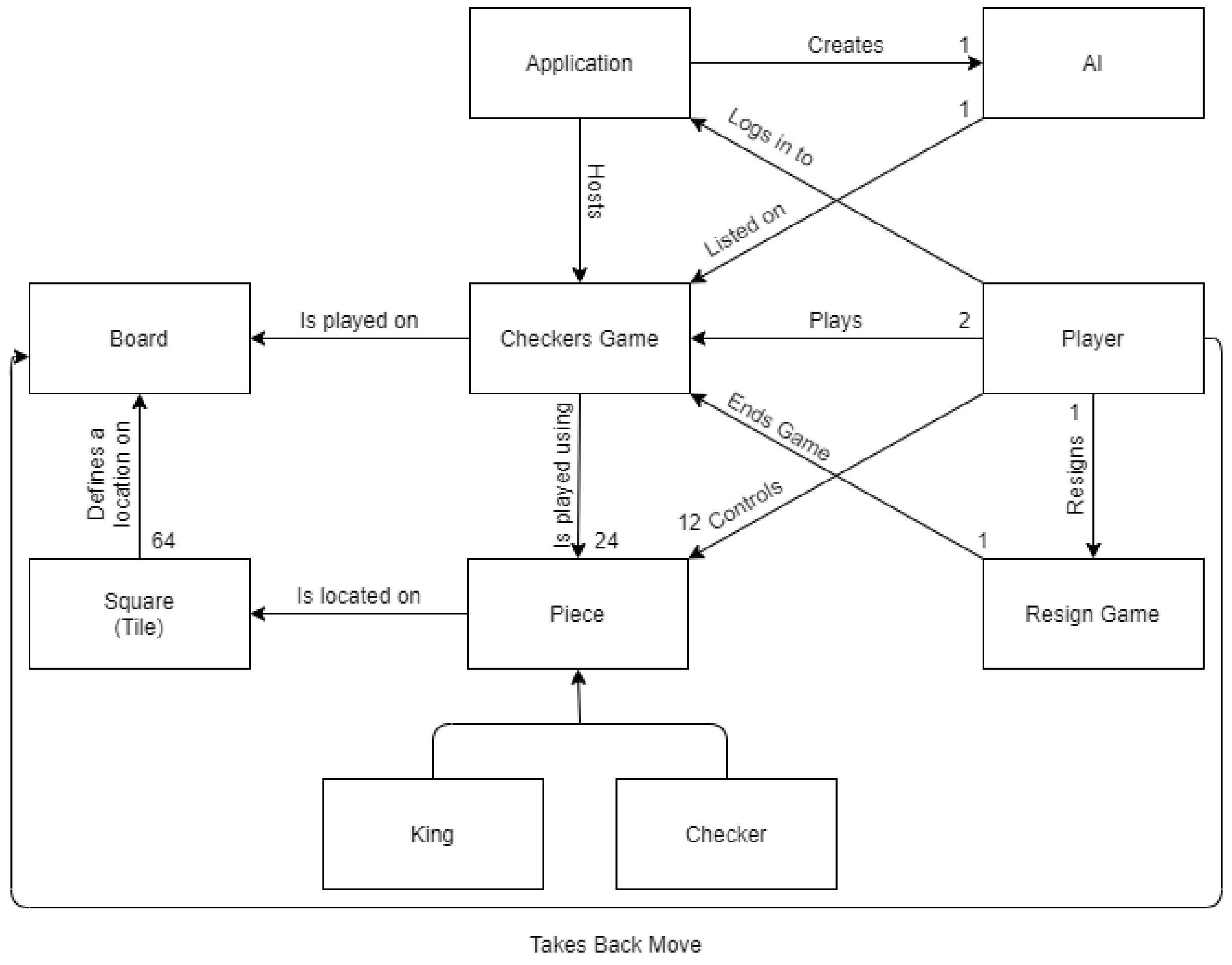
- Kings
  - As a Player, I want to get king pieces so tha tI have better pieces to use against my opponent.
- Resign
  - As a Player, I want to resign from a game so that I can stop playing checkers.
- Undo
  - As a Player, I want to undo my previous move so that I can make a different move.

Roadmap of Enhancements

No enhancement is required for this group due to the small size of the group. AI enhancement is implemented using minimax algorithm. The purpose of the minimax algorithm is to make the AI difficult to defeat.

Application Domain

This section describes the application domain.



The Application hosts the Checkers Game which users may log into to play or watch others play as a Spectator. They are also given the option to watch Replays of their previously played games. Every game is played by 2 Players who take turns controlling 12 pieces each on a 8x8 Board. Pieces start as normal pieces and may become King pieces during the process of the game.

Architecture and Design

This section describes the application architecture.

Summary

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

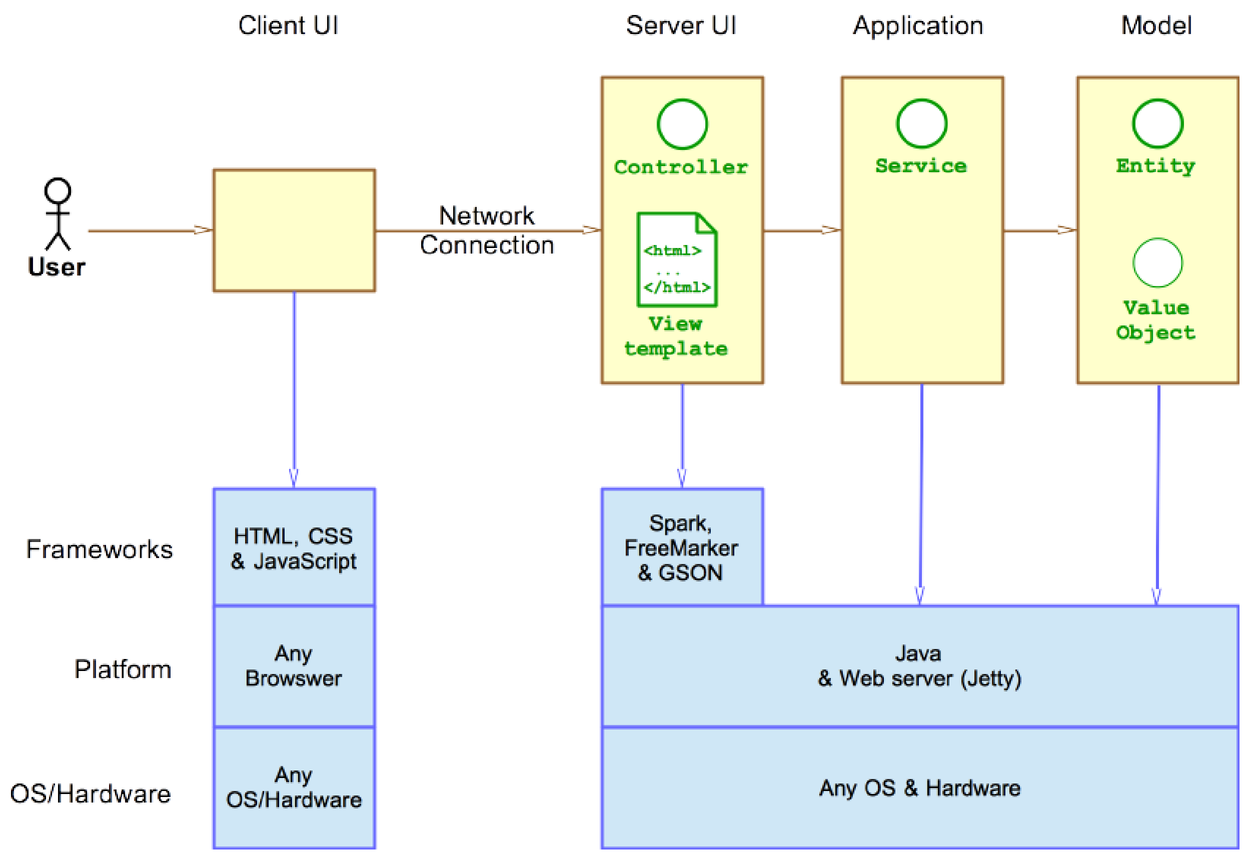


Figure 1: The Tiers & Layers of the Architecture

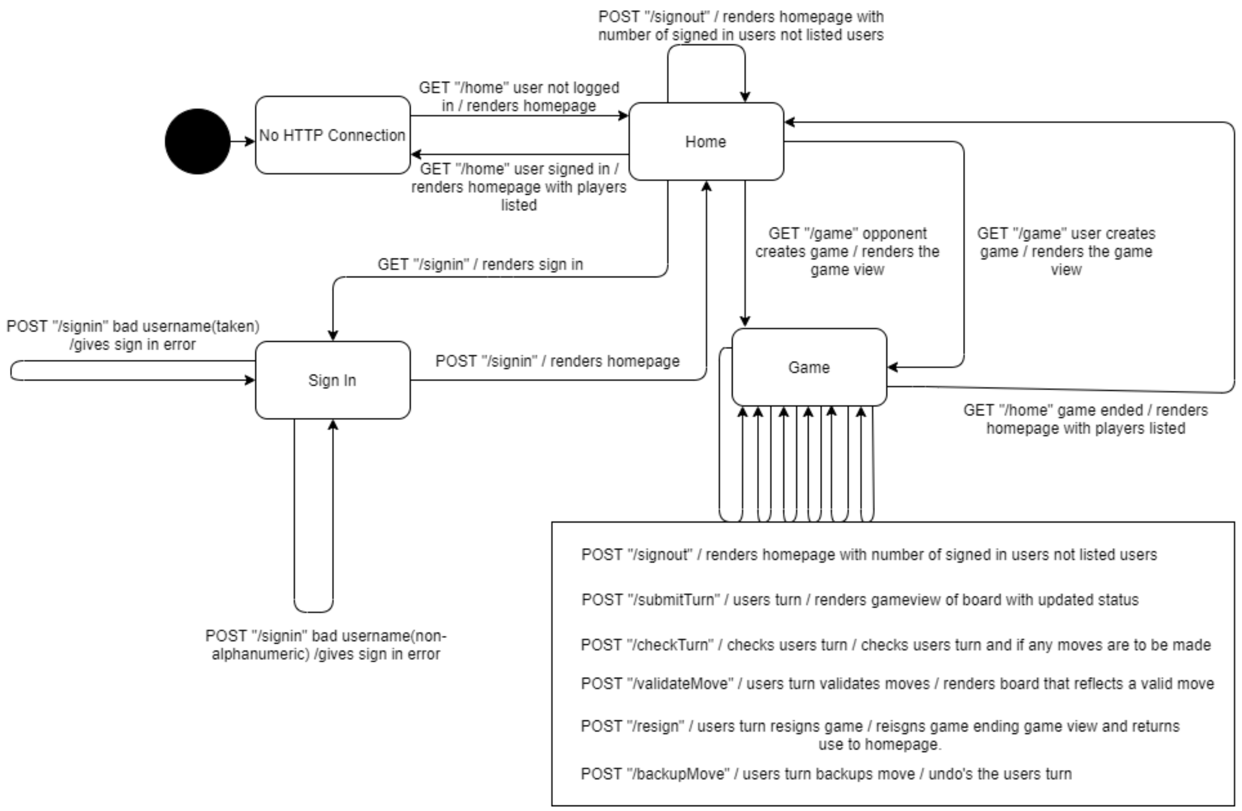
As a web application, the user interacts with the system using a browser. The client-side of the UI is composed of HTML pages with some minimal CSS for styling the page. There is also some JavaScript that has been provided to the team by the architect.

The server-side tiers include the UI Tier that is composed of UI Controllers and Views. Controllers are built using the Spark framework and View are built using the FreeMarker framework. The Application and Model tiers are built using plain-old Java objects (POJOs).

Details of the components within these tiers are supplied below.

Overview of User Interface

This section describes the web interface flow; this is how the user views and interacts with the WebCheckers application.


POST "/signout" / renders homepage with number of signed in users not listed users
GET "/home" user not logged in / renders homepage
No HTTP Connection
Home
GET "/home" user signed in / renders homepage with players listed
GET "/signin" / renders sign in
GET "/game" opponent creates game / renders the game view
GET "/game" user creates game / renders the game view
POST "/signin" bad username(taken) /gives sign in error
Sign In
POST "/signin" / renders homepage
Game
GET "/home" game ended / renders homepage with players listed
POST "/signout" / renders homepage with number of signed in users not listed users
POST "/submitTurn" / users turn / renders gameview of board with updated status
POST "/checkTurn" / checks users turn / checks users turn and if any moves are to be made
POST "/validateMove" / users turn validates moves / renders board that reflects a valid move
POST "/resign" / users turn resigns game / reisgns game ending game view and returns use to homepage.
POST "/backupMove" / users turn backups move / undo's the users turn
POST "/signin" bad username(non-alphanumeric) /gives sign in error

The interface is made up of 3 main pages: Home, Game, Login. The user will get to the Home page and Login. Logging in will render the new Home page where players are able to challenge other logged in players. Playing a game will render the Game page and after the game is complete, the players return to the Home page with the lobby.

UI Tier

The server-side UI tier is responsible for mapping the HTTP and Routes to the Controller that is responsible for handling the interaction. This is accomplished by WebServer.

###Controllers for ViewModel and Redirecting

Controller	FreeMarker	Function
GetSignInRoute	signin.ftl	Displays sign-in page
GetHomeRoute	home.ftl	Displays home page and player lobby
GetGameRoute	game.ftl	Displays game page and sets up the game
PostSignInRoute	redirects page	Redirects to home page when sign-in is a success
PostSignOutRoute	redirects page	Redirects to sign out page

###Controllers for AJAX and JSON POJO

Controller	Request	Response
PostBackupMoveRoute	NA	Backup message
PostCheckTurnRoute	NA	Check turn message

Controller	Request	Response
PostSubmitTurnRoute	NA	Submit turn message
PostResignRoute	NA	Resign message
PostValidateMove	Move	Valid move message

####Sequence Diagram for PostSignInRoute

Application Tier

The application tier is made up of components that handle the server-wide interactions between the players, and the application using GRASP.

Model Tier

The model tier shows the board of the checker game depending on the player. It encompasses the two players, checker pieces, and spaces which with interact together to make a move.

Design Improvements

If the project were to continue, then the team will work to implement enhancements such as Spectator Mode and Watch Replays. For the current design, we would like to tighten the code where we do not repeat calling functions within a function using dot notation. This lengthens the code and makes it difficult to read for the programmer. Our code metrics passed the targeted complexity as unit, but some modules did not meet the target. GetGameRoute and GetHomeRoute have a Cavg of 5 while PostSubmitTurnRoute has a Cavg of 4. These hot spots are not that significant, and the program runs without defects so, we decided to not redesign them. However, we have a high WMC of 107 for the Game module. This was alarming at first, but after some thought we believe this should be the game considering Game contains the core logic of the program and therefore should be complex. Other hotspots pertain to the AI in our efforts to make the AI extremely difficult to defeat. AIPlayer and BoardViewTest have a Cavg of 4 which and GameState have a WMC of 32. These hotspots did not concern us much. Even though GameState has a large outlier, it makes sense since it is similar to Game - they both carry the core logic for their respective purposes in the program.

Testing

Testing went smoothly for the majority of the program. We found two bugs during testing. The first bug allowed users to sign in with the name “Jon Snow”, but only portray “Jon”. This new “Jon” would be different from “Jon” that signs in before or after them. The second bug was when a player signs out during a game, the other player will still remain in the game. These bugs were simple fixes.

Acceptance Testing

All user stories pertaining to the MVP have passed their testings to meet the acceptance criteria. All user stories pertaining to the AI enhancement has their testing to the acceptance criteria.

Unit Testing and Code Coverage

Our unit testing and code coverage strategy was to start with the smallest and simplest classes. By doing so, we can get the easiest unit tests out of the way first and then group up for the larger and more difficult unit tests. Unit testing have been implemented for the majority of the classes. As of now, only half of the unit tests have passed. The ones that did not pass were at 0% which came to us as an anomaly. Upon further inspection, due to the constant updates and altering of the code, we did not apply the correct unit testing for some classes. If this project is to continue, we would like update the unit testing for code coverage and put forth more effort in being aware that each members’ updates to the code need to be accounted for in the unit testing and code coverage.

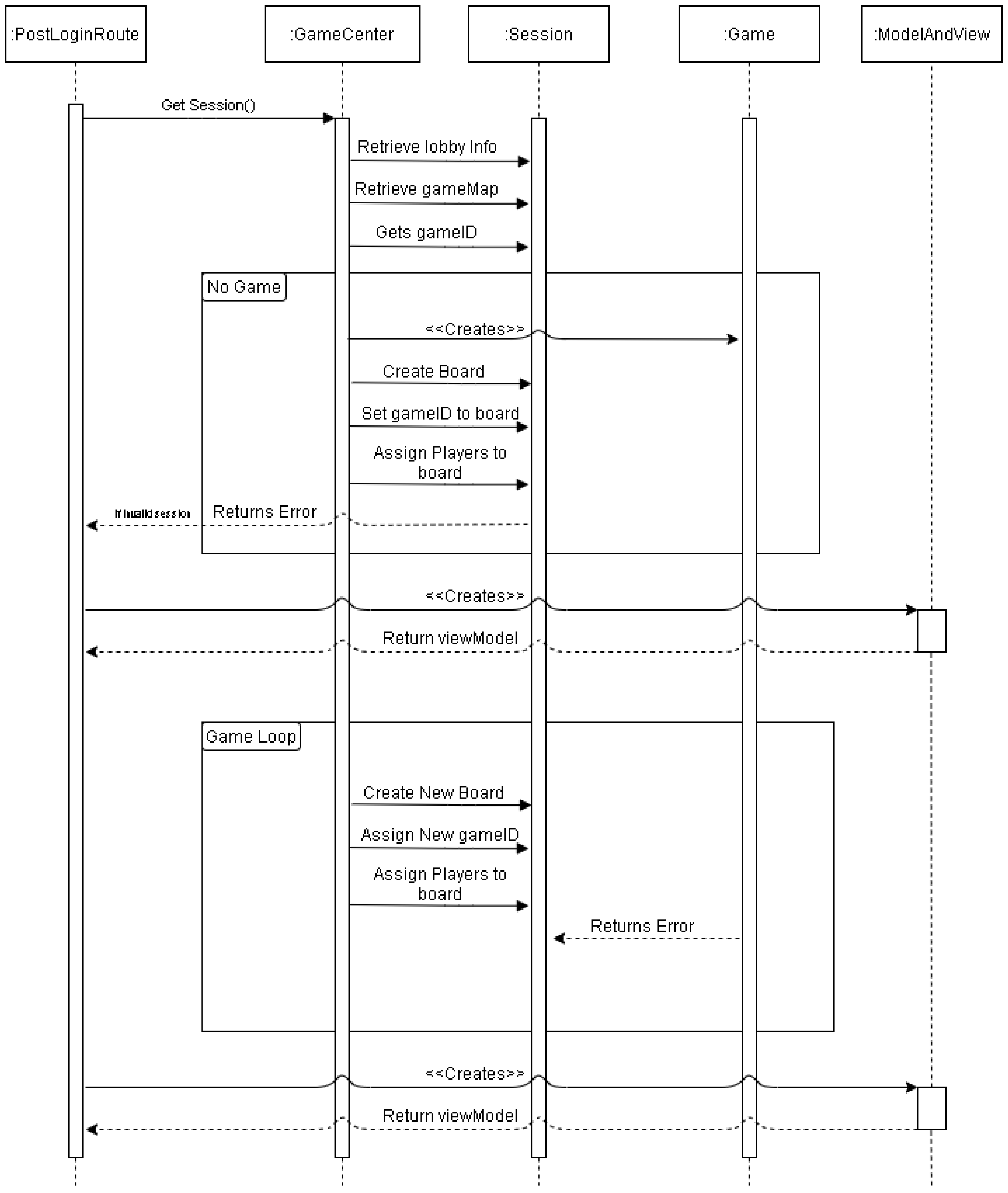


Figure 2: img_2.png