KingMe
Software Design Document

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Revision History

Name	Date	Reason for Change	Version
Vincent Finn	8/7/2018	First Draft – Sections Outlined and assigned	0.9
Vincent Finn	8/10/2018	Section 4 filled in	0.9.1
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William Brown, Chris Deslongchamp, Matthew Quaschnick, Vincent Finn	8/12/2018	Reviewed. Comments addressed and changes made based on comments.	1.1

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1. Introduction

1.1 Purpose of Document

This document is to describe the implementation of King Me software as described in the King Me Requirement document. King Me is an online two-player checkers game using professional checkers tournament rules.

1.2 Scope of Document

This document describes the implantation details of the King Me software. The software consists of several systems that will be split into two main namespaces, host and client. The host and client share many of the same functions but differ in how the initial connection is made. Code in the host is intended to host the game and the connection between the players. The client code is intended to join the game. Both the client and host are able to make moves and perform tasks in the game in the same way.

2. System Overview

2.1 Description of Software

King Me is designed to be an online two-player checkers game utilizing professional tournament rules. Players will take turns making moves and jumps. The game will end once player has captured all the other player's tokens or forces one player to make the same three moves resulting in a win, both players make the same three moves resulting in a tie, or one player surrenders.

2. 2 Technologies Used

King Me will use two PC (laptops or desktops) that utilize the Windows 10 operating system. Operating systems like Mac and Linux may be supported if time permits. One player will use their machine to host the game while the other uses their machine to join the game. Once both players have connected, they will make their moves on their own machine until the game ends.

3. System Architecture

3.1 Architectural Design Components

Server Application – The user interacts with the Server application to allow the player to start the process of hosting a game. The player will be able to see their host name, so they can supply that to the player who will join.

Server Class – A class that handles all the socket communications and connections for hosting a game. It also has access to the ServerCheckersGame Class.

ServerCheckersGame Class – A class to keep track of all games currently in progress. When a player chooses to host a game (become the server) their game is added to this class and kept track of incase players disconnect.

Client Application – The user interacts with the Client application to allow the player to join a game that needs an opponent (host is the only player in the game). The player will be able to search for a specific host or choose a random opponent.

Client Class – A class that handles all the socket communications and connections for joining a game.

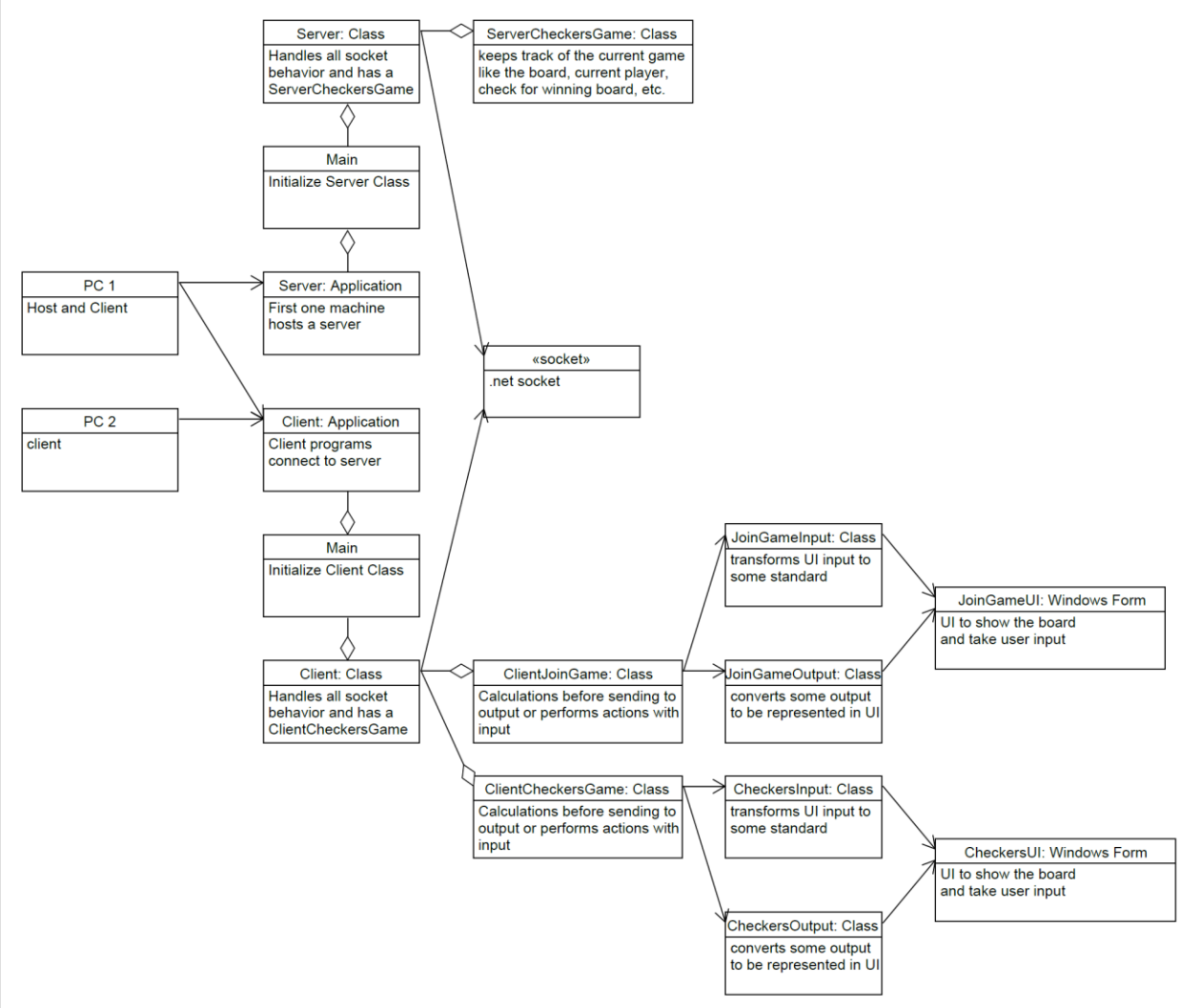
CheckersGame Class – A class that handles calculations such as move verification, jump verification, as well as board arrangement, timer, and pause functions. This class also checks if an end game state has been reached and calls on the GameOver class if one has been reached.

Checkers Input Class – A class that receives the opponents move/action, deciphers the input, and displays the board changes or action requested. Once the message is received it sends a verification to the opponent.

Checkers Output Class – A class that encodes the players move/action and sends it to the opponent. The class awaits a verification that the message has been received. If one is not received, it sends the message again until it is received.

CheckersUI Windows Form – Displays the checker board UI for the player.

GameOver Class – A class that checks the current board state if the game is over by either a win, tie, or surrender.



3.2 Design Rationale

Why socket connections?

The C# language has a Peer-to-Peer library that utilizes socket connections to transfer data between two machines. We can utilize the library to help make our data transfers and connections easy to set-up.

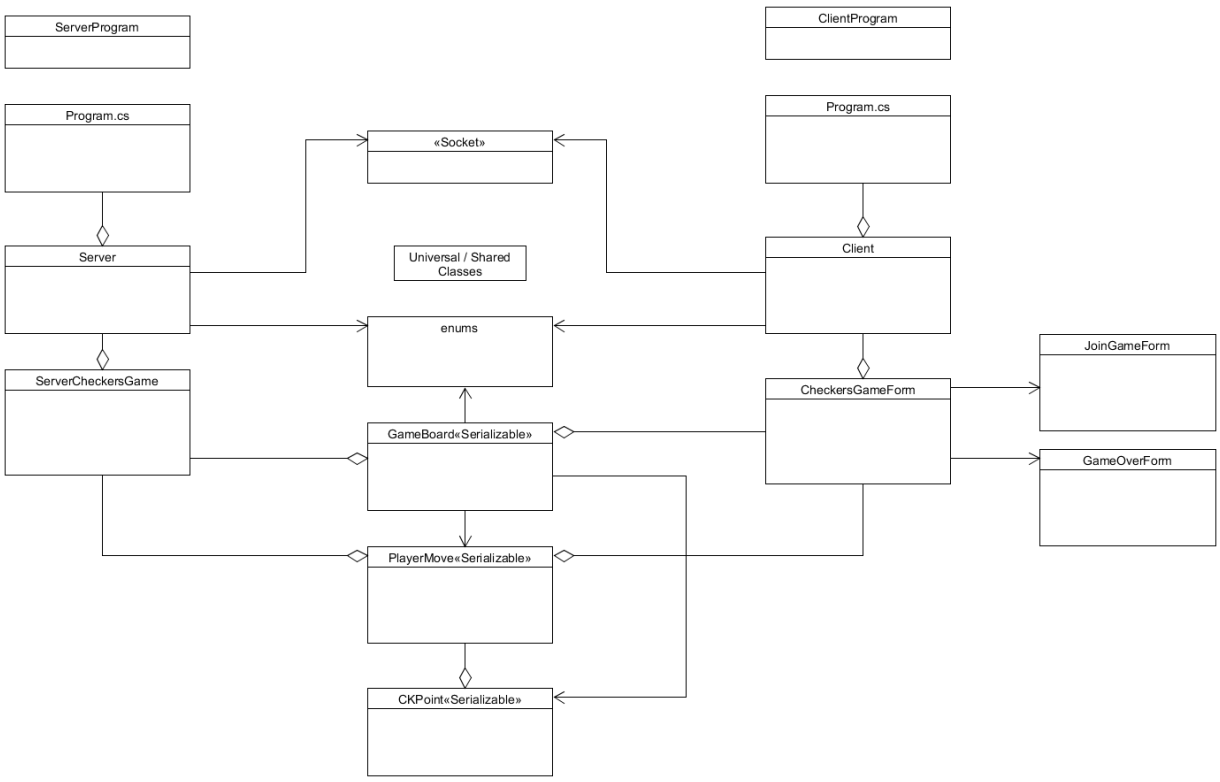
Why encode moves and actions on the player's machine and then decipher them on the opponent's machine?

We felt that encoding our messages will allow us to send shorter packages across our connections. This will also allow us to check what is being sent to the opponent and verify that the information is correct by having and established syntax for the messages.

4. Component Design

4.1 Overview

In this section, more details on each component are given. For each component, UML and a brief description are given.

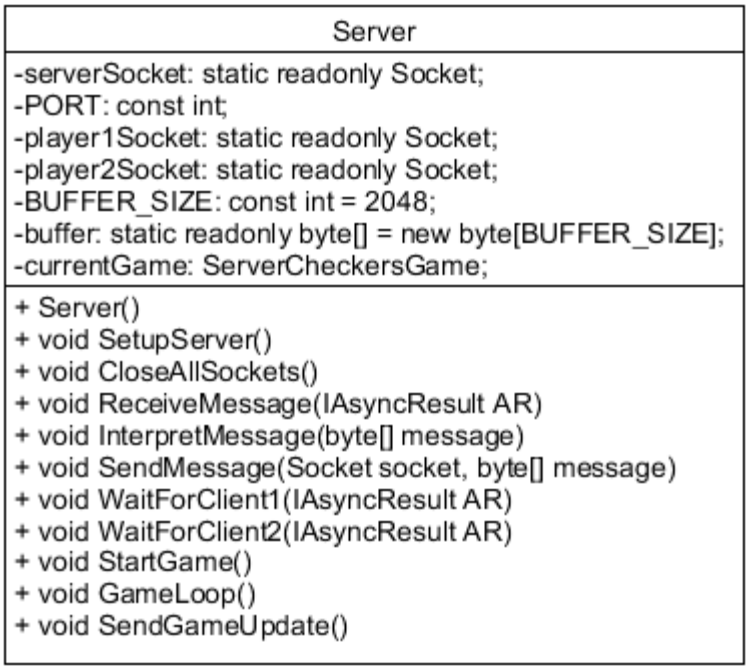


4.2 Server Program

The Server Program would be run on its own, wait for 2 players to connect, then start a loop to keep sending game updates to clients until the game is over.

4.2.1 Server.cs

The Server Class is responsible for handling all of the networking interactions using the ServerCheckersGame class to make decisions on what to do. It can receive a message from the client, either expected or unexpected, and needs to send a reply to an individual client with a message with instructions each client will interpret.



4.2.2 Server Attributes

Name	Type	Description
serverSocket	Static readonly Socket	Used as the server side socket that needs to opened so that clients can connect.
PORT	Const int	Port that server and clients connect on
player1Socket	Static readonly Socket	Used as the socket for the first client who joins.
Player2Socket	Static readonly Socket	Used as the socket for the second client who joins.
BUFFER_SIZE	Const int = 2048	Size of the buffer
buffer	Static readonly byte[] = new byte[BUFFER_SIZE]	Byte array that is the size of BUFFER_SIZE

currentGame	ServerCheckersGae	Used to keep track of the current state of the game, and do things like applyMove
player1Ready	Bool	Used to see if Player1 is ready to receive a message
player2Ready	Bool	Used to see if player2 is ready to receive a message

4.2.3 Server Methods

Server()	
Input:	Void
Output:	Void
Description:	Constructor for the server class

Void SetupServer()	
Input:	Void
Output:	Void
Description:	Sets up the server socket and opens it. Then calls WaitForClient1()

Void CloseAllSockets()	
Input:	Void
Output:	Void

Description:	Simply Closes The Client Sockets, then the Server Socket gracefully.

Void ReceiveMessage(IAsyncResult AR)	
Input:	Asynchrounous result needed to wait for a client message on a separate thread
Output:	Void
Description:	Used to Wait for messages from clients with Socketname.BeginReceive(buffer, 0, BUFFER_SIZE, SocketFlags.None, ReceiveMessage, current); restarts itself after handling the message it received.The client needs to send an update letting the server know that it is ready to receive messages.

Void InterpretMessage(byte[] message)	
Input:	A byte[] received from the client
Output:	Void
Description:	Reads the first byte and converts to an int and uses a switch statement and MessageIdentifierrs enum to decide what to do. Example if first byte is 2, then it would Take the rest of the byte[], deserialize it and cast it as a PlayerMove, an try to apply it to the gameboard.

Void SendMessage(Socket socket, byte[] message)	
Input:	The socket we are sending a message to, and the message in a byte[]

Output:	Void
Description:	Sends the given message to a given socket. It should only be able to send a message if that client is ready to receive.

Void WaitForClient1(IAsyncResult AR)	
Input:	Asynchrounous result needed to wait for a client message on a separate thread
Output:	Void
Description:	Waits for the first Client to connect. When they do, it sets player1Socket to the current socket, waits to receive the first ready message from that client, then starts WaitForClient2

Void WaitForClient2(IAsyncResult AR)	
Input:	Asynchrounous result needed to wait for a client message on a separate thread
Output:	Void
Description:	Waits for the second Client to connect. When they do, it sets player2Socket to the current socket, waits to receive the first ready message from that client, then sends it a “StartingGame” message, and “Player2”, then it makes sure that client1 is ready, and sends it the same message with “Player1”, then calls StartGame()

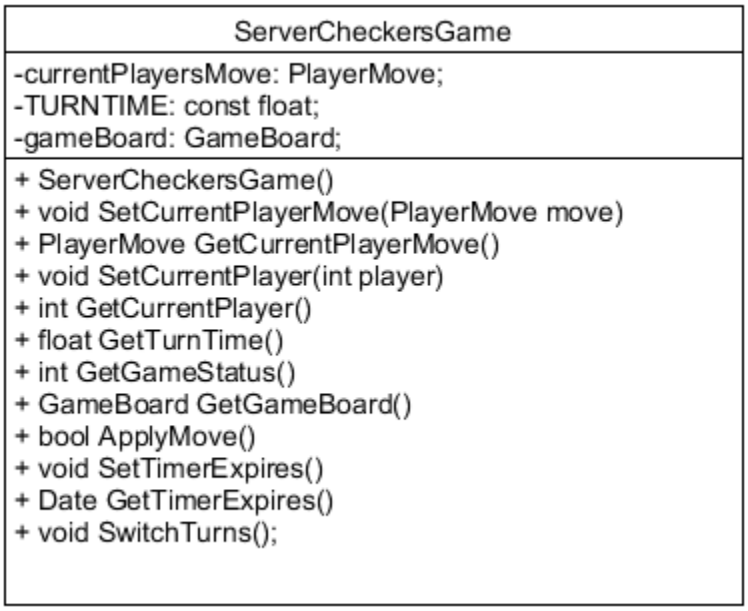
Void GameLoop()	

Input:	Void
Output:	Void
Description:	Handles most of decision making of the game. Continues to sendGameUpdates to the clients an receiving moves or pause requests until currentGame.GetGameStatus is anything than InProgress. Make sure to wait until both players are receiving to start the next turn.

SendGameUpdate()	
Input:	Void
Output:	Void
Description:	Sends a GameUpdate message to both clients with a serialized Gameboard object

4.2.4 ServerCheckersGame.cs

The ServerCheckersGame class contains the gameboard and keeps track of the current state of the game, and uses the gameboard for things like applying moves and checking for a winner or tie.



4.2.5 ServerCheckersGame Attributes

Name	Type	Description
currentPlayersMove	PlayerMove	Holds the Move the current player sent so that try to be applied to the board
TURNTIME	Const float	The amount of seconds a player should have to submit a move
gameBoard	GameBoard	The current gameboard object

4.2.6 ServerCheckersGame Methods

ServerCheckersGame()	
Input:	Void
Output:	Void

Description:	Constructor for the ServerCheckersGame class

Void SetCurrentPlayerMove(PlayerMove move)	
Input:	The playermove we want to set
Output:	Void
Description:	Set currentPlayersMove

PlayerMove GetCurrentPlayerMove()	
Input:	Void
Output:	currentPlayersMove
Description:	Get currentPlayersMove

Void SetCurrentPlayer(int player)	
Input:	1 or 2 for player id
Output:	Void
Description:	Set currentPlayer in GameBaord

Int GetCurrentPlayer()	

Input:	Void
Output:	1 or 2 for player id
Description:	Get CurrentPlayer out of gameBoard

Float GetTurnTime()	
Input:	Void
Output:	TURNTIME
Description:	` Get TURNTIME

GameStatus GetGameStatus()	
Input:	
Output:	GameStatus from gameboard
Description:	Get GameStatus from gameboard

GameBoard GetGameBoard()	
Input:	

Output:	gameBoard
Description:	Get gameBoard

Bool ApplyMove()	
Input:	Void
Output:	True if applyMove succeeded, false if the move was invalid
Description:	Try to apply the currentPlayersMove to update the gameboard. If the move is invalid, return false, otherwise return true.

Void SetTimerExpires()	
Input:	Void
Output:	Void
Description:	Set the date of when the timer will expire

Date GetTimerExpires()	
Input:	Void
Output:	timerExpires from gameboard

Description:	Get the Date the timerexpires from gameboard

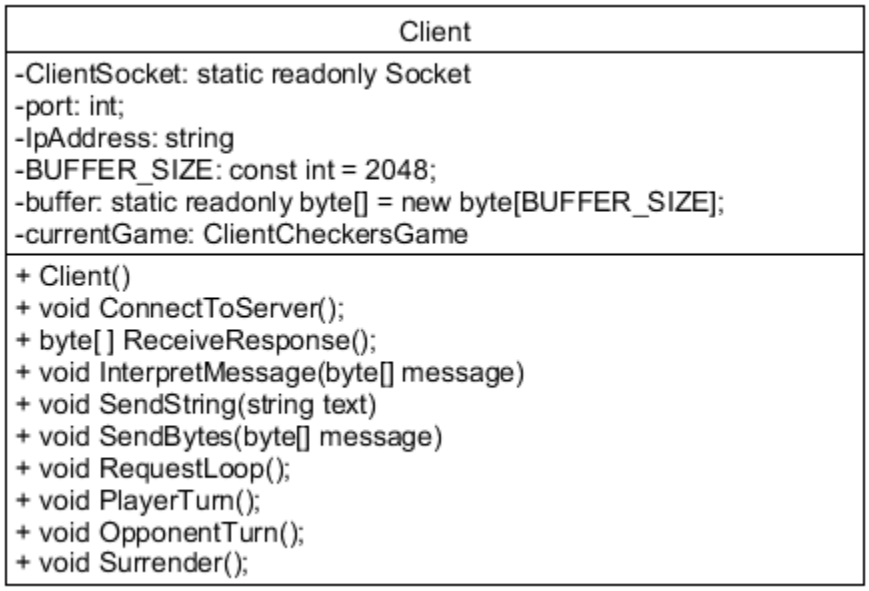
Void SwitchTurns()	
Input:	Void
Output:	
Description:	Change the CurrentPlayer in Gameboard to the next player, start new timer

4.3 Client Program

The Client Program directs which UI form is currently needed, connects to the server using the IP address and port given by the user, and keeps waiting until it is the clients turn and allows players to submit moves which get sent to the server.

4.3.1 Client.cs

The Client class handles most of the networking, and uses a currentGame object to help update the gameboard and get player moves when the client is told by the server that it is their turn.



4.3.2 Client Attributes

Name	Type	Description
ClientSocket	Static readonly Socket	Holds the current socket connection for this client
bort	Int	The Port value used to connect to a server
ipAddress	String	The ipAdress used to connect to a server
BUFFER_SIZE	Const int = 2048	The size of the buffer used to get messages
buffer	Static readonly byte[] = new byte[BUFFER_SIZE]	Used to hold the data received from the server
currentGame	ClientCheckersGame	Used to do stuff regarding the checkers game

4.3.3 Client Methods

Client()	
Input:	Void
Output:	Void
Description:	Constructor for the Client class

Void ConnectToServer()	
Input:	Void
Output:	Void
Description:	Use the JoinGameForm to get the ipAddress and port, and try to connect to the server when the user clicks join game.

byte[] ReceiveResponse()	
Input:	Void
Output:	Return the message as a byte[]
Description:	Wait for a response from the server and return it as a byte[]

Void InterpretMessage(byte[] message)	
Input:	A byte[] received from the client
Output:	Void

Description:	Reads the first byte and converts to an int and uses a switch statement and MessageIdentifierrs enum to decide what to do. Example if first byte is 2, then it would Take the rest of the byte[], deserialize it and cast it as a GameBoard, and Update the current gameboard, and if it is this clients turn wait for them to submit a move, or for the server to send a message that their time is up.

SendString(string text)	
Input:	Text to send
Output:	Void
Description:	Convert the text to a byte[] and send it to the server

Void SendBytes(byte[] message)	
Input:	A byte[] of something that was probably already serialized
Output:	Void
Description:	Send the given byte[]

Void RequestLoop()	
Input:	Void
Output:	Void
Description:	Continously call ReceiveResponse() and do something based on the response received,

	until the gamestatus is anything other than InProgress

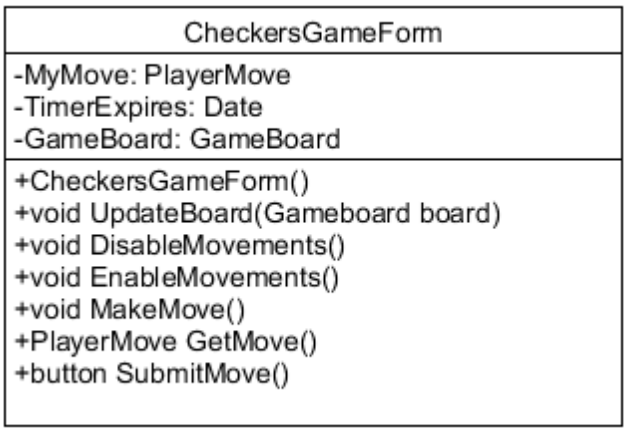
Void PlayerTurn();	
Input:	Void
Output:	Void
Description:	It is currently this clients turn, wait for them to submit a move, then send it. Should be canceled if the server sends a game update or pause request.

Void OpponentTurn()	
Input:	Void
Output:	Void
Description:	Disable the ability for the client to move pieces until it is their turn, wait for a gameupdate

Void Surrender()	
Input:	Void
Output:	Void
Description:	Send a message to the server saying that you giveup

4.3.4 CheckersGameForm.cs

The ClientcheckersGame class holds the gameboard object and other things needed to keep track of the current state of the checkers game on the client's end



4.3.5 CheckersGameForm Attributes

Name	Type	Description
MyMove	PlayerMove	Holds the Move the current player needs to send so that try to be applied to the board
TimerExpires	Date	Time when the player will forfeit his turn
gameBoard	GameBoard	The current gameboard object

4.3.6 CheckersGameForm Methods

CheckersGameForm()	
Input:	Void
Output:	Void
Description:	Constructor for the ClientCheckersGame class

Void UpdateBoard(GameBoard board)	
Input:	Given a gameboard
Output:	Void
Description:	Set the gameBoard = board

void DisableMovements()	
Input:	Void
Output:	Void
Description:	Stop the player from being able to submit a move

void EnableMovements()	
Input:	Void
Output:	Void
Description:	Allow the player to submit moves again

void MakeMove()	
Input:	Void
Output:	Void
Description:	Wait for the player to use the UI to make a move. Needs to be canceled if the server

	sends an update and it is no longer the players turn

PlayerMove GetMove()	
Input:	Void
Output:	MyMove
Description:	Get the MyMove variable

button SubmitMove()	
Input:	Void
Output:	MyMove
Description:	The user pushed the submit move button

4.4 Universal / Shared Classes

The Client Program directs which UI form is currently needed, connects to the server using the IP address and port given by the user, and keeps waiting until it is the clients turn and allows players to submit moves which get sent to the server.

4.4.1 Enums

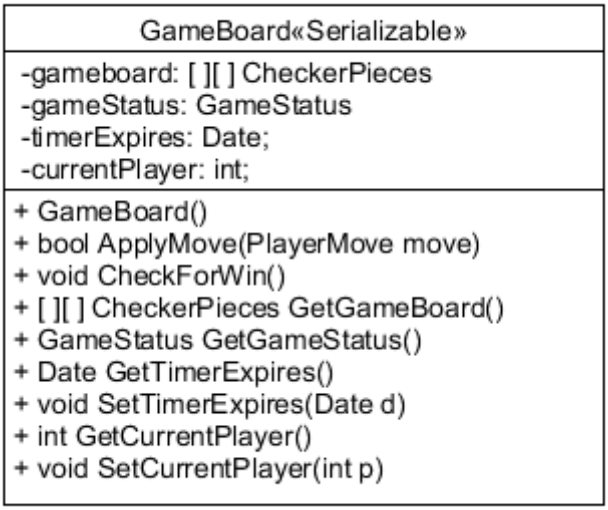
Three Enums used by Both Server and Client
enum MessageIdentifiers { WaitingForOpponent, StartingGame, GameUpdate, RetryGameUpdate, GameOver, PauseRequest, Pausegame}

enum GameStatus {InProgress, Player1Wins, Player2Wins, Draw}

enum CheckersPieces {Red,RedKing, Black,BlackKing}

4.4.2 GameBoard

The GameBoard Object will be what we use to represent the checkers gameboard. It will have an array of arrays of CheckersPeices values which correspond to the rows and columns of a checkers board. It has methods to apply moves and check for a game ending status. It is also serializable, so that it can be transferred across the network.



4.4.3 GameBoard Attributes

Name	Type	Description
gameBoard	[ ] [ ] CheckerPieces	The data structure for the checkers board
gameStatus	GameStatus	Value of the current game status
timerExpires	Date	Date that the timer will expire
currentPlayer	Int	1 is player 1, 2 is player 2

4.4.4 GameBoard Methods

GameBoard()	
Input:	Void
Output:	Void
Description:	Constructor for the GameBoard class

Bool ApplyMove(PlayerMove move)	
Input:	A player move trying to be applied
Output:	True if the move was applied, false if it couldn't be applied
Description:	Try to apply a move to the gameboard, and return if it was a success or not.

GameStatus CheckForWin()	
Input:	Void
Output:	gameStatus
Description:	Analyze the board and return the status.

[ ] [ ] CheckerPeices GetGameBoard()	
Input:	Void
Output:	The data structure for the board
Description:	Return the data structure for the board

GameStatus GetGameStatus()	
Input:	Void
Output:	gameStatus
Description:	Get gameStatus

Date GetTimerExpires()	
Input:	Void
Output:	timerExpires
Description:	Get timerExpires

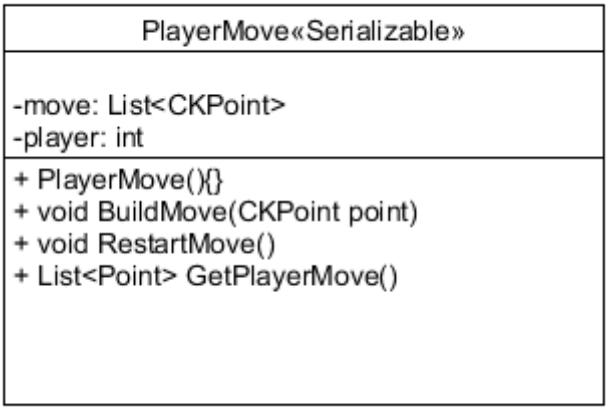
Void SetTimerExpires(Date d)	
Input:	Date d
Output:	Void
Description:	Set the timerExpires with the given date

Int GetCurrentPlayer()	
Input:	Void
Output:	currentPlayer
Description:	Get currentPlayer

Void SetCurrentPlayer(int p)	
Input:	Player Id
`	Void
Description:	Set currentPlayer with the given int

4.4.5 PlayerMove

The PlayerMove is the object for building a player move, from given CKPoints. It is serializable so the clients can send their moves to the server



4.4.6 PlayerMove Attributes

Name	Type	Description
Move	List<CKPoints>	The data structure for the playerMove
Player	Int	Value of the current player making the move

4.4.7 PlayerMove Methods

PlayerMove()	
Input:	Void
Output:	Void
Description:	Constructor for the PlayerMove class

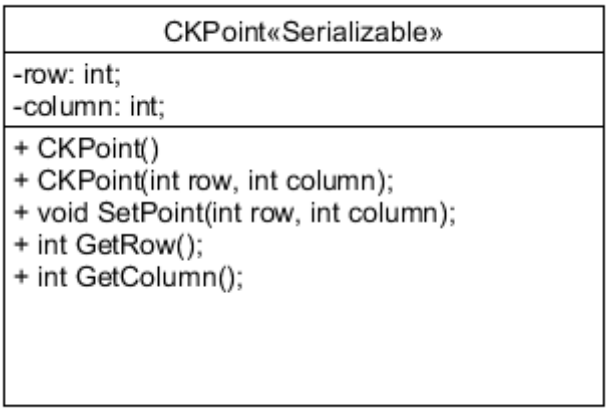
Void BuildMove(CKPoint point)	
Input:	A point
Output:	Void
Description:	Appends the point to move

Void RestartMove()	
Input:	
Output:	Void
Description:	Clears the list to start a fresh move

List<Point> GetPlayerMove()	
Input:	Void
Output:	Move
Description:	Gets move

4.4.8 CKPoint

A simple class to act as a point to easily access a part of the gameBoard.



4.4.9 CKPoint Attributes

Name	Type	Description
row	Int	The row index
column	Int	The column index

4.4.10 CKPoint Methods

CKPoint()	
Input:	Void
Output:	Void
Description:	Constructor for the CKPoint class

CKPoint(int r, int c)	
Input:	Row and column
Output:	Void
Description:	Constructor for the GameBoard class that immediately initializes the point

Void SetPoint(int r, int c)	
Input:	Row and column
Output:	Void
Description:	Set point with given r and c

Int GetRow()	
Input:	Void
Output:	Row
Description:	Get row

Int GetColumn()	
Input:	Void
Output:	Column
Description:	Get column

5. Human Interface Design

5.1 UI Overview

In this section, more details on UI design are given. Each subsection contains details, and some contain a diagram as well.

5.2 Screen Objects and Actions

Server
The intended input method for use on the server is a mouse. There are not many inputs on the server. After the game has been started via the server the rest of the game is played through the client.
Client
The intended input method for use on the client is a mouse. The mouse can be used to access various menus as well as move the checkers pieces.

5.3 Server Menu Flow

The server's screen flow is very simple as it only consists of one screen with multiple buttons. A button to restart the game early, a button to end the game early and a button to disconnect a player.

5.4 Client Menu Flow

Below is a listing of the client's screen flow for convince: