Swansea University

Computer Science

Software Requirements Specification

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Contents

Revision History

Name	Date	Reason of changes	Version
Simon Hewitt	28/3/15	Added Requirements	0.1
7	8	9	11

1 Introduction

1.1 Purpose

This document describes the creation of an interactive Chess game by the authors as the submission for module **M24 Software Team Project**, an element of the MSc in Computer Science at Swansea University. The Chess game requirements are described in the project assignment [1], this document formalises those requirements and clarifies them with derived requirements or by open issues.

1.2 Document Conventions

Code extracts are shown in `Courier mono-spaced font`

1.3 Intended Audience and Reading Suggestions

This document is intended for two audiences, the customer commissioning the game application, Dr Ben Mora, and for the developers and testers charged with creating the app. It is necessary to be familiar with [1] to fully understand and utilise this document.

1.4 Product Scope

The product, a game application, is intended to be a relatively simple and entry-level chess game that is none the less fully functioning and useable by beginner or expert Chess players. By using an open source Chess engine we expect to be able to provide a challenging game to expert players. By providing a network capability, we can provide the opportunity for two players to play at a remote distance, for instance while both attending different lectures.

1.5 References

References are listed at the end of the document

2 Overall Description

2.1 Product Perspective

It should be born in mind that this product is created in a single module undertaken in one semester of our MSc course, so cannot expect to be as comprehensive or as polished as the many free and commercial chess games available. However we hope to produce an attractive game that can be played by beginner through to expert level Chess players.

2.2 Product Functions

The Chess game is started by a human User. When starting a new game, the user can select to play herself, against another human player, or against a computer Chess Engine, or against another instance of this app

that is available on an IP network. Or she can select for the Chess Engine to play itself or to play a network player (which in turn could be a human or an engine).
The game app has the expected usual functions of Player profiles including games won and lost, a live Game score, and a game list so the user can review the most recent game.

2.3 User Classes and Characteristics

This simple game app has only a single class of User, the game player. There are no administrative functions requiring elevated security.

2.4 Operating Environment

3 Environment

The team members use different desktop OS including Linux, OS X and Windows, so tools must support each of these. The software development tools will be:

Component	**Selection**	**Justification**
Language	Java V8 JVM	The standard, current Java version from Sun
IDE	Eclipse or NetBeans	Individual choice
Desktop	OS X, Windows, Linux	Individual Choice
Source and version control	GitHub	De facto standard, free, open source
Desktop source and version control	none specified, default is Git command line or GitHub 2	Individual choice. GitHub2 is also open source
Documentation	LaTeX	works well with GIT and is an academic standard
Code documentation	Doxygen	An alternative to JavaDocs, a general de facto standard. Free and open source.
Informal Collaboration	Facebook	De facto standard. Free
Testing	JUnit	The most widely used Java testing framework, simple to adopt. Free and open source.
GUI Testing	Abbot	Eclipse plugin to handle testing which JUnit cannot
Code Quality	CodePro Analytix and PMB	Eclipse plugins which aid coding quality
Test runner	To be decided	Nightly build and test sequence is desirable
Time Management	TFS and Gnatt chart	Gantt chart, WBS

The user desktop OS is of course an attribute of the devices (laptop, PC) used. Apart from that, each of these tools is open source with an existing track record of being long lived, widely used and with a healthy development community actively supporting them. In each case they are an accepted de-facto choice for their purpose.

3.1 Design and Implementation Constraints

Design manager (whohe?)

Describe any items or issues that will limit the options available to the developers. These might include: corporate or regulatory policies; hardware limitations (timing requirements, memory requirements); interfaces to other applications; specific technologies, tools, and databases to be used; parallel operations; language requirements; communications protocols; security considerations; design conventions or programming standards (for example, if the customer's organization will be responsible for maintaining the delivered software).

3.2 User Documentation

No external User Documentation will be created. The App **Help** pages will be sufficiently detailed to enable a new user to play the game. We will not be explaining the rules of Chess, but the game board does not allow illegal moves to be made, so the game can also act as a tutor to new players, to some extent.

3.3 Assumptions and Dependencies

Known assumptions are listed below in table 1

Table 1: Assumptions Risks Issues and Dependencies

Number	Text	Type	Priority
ARID-1:	The application will be an on-device app coded in Java	Assumption	*High*
ARID-2:	A suitable Chess engine can be found that can be executed in the technical environment	Risk	*High*
ARID-3:	The Portable Game Notation [2] or UIC [3] is suitable for exchanging move data over a network	Assumption	*High*

4 External Interface Requirements

4.1 User Interfaces

The User interface will be a Graphical 2D interface designed for pointer use (mouse or touch, depending on the device). Game control actions such as 'New Game', 'End Game', may be by a menu interface, by action buttons on screen or some combination of these, this design detail is still to be resolved.
No special skills will be needed to use the interface, and it will adopt well known modern idioms for software game play.
Within the limitations of our time and the technologies available, we will be unable to add special accessibility provision for people with disabilities, and in particular, reasonable eyesight will be necessary to play the game.

4.2 Hardware Interfaces

The application requires limited hardware interfaces. A screen with modest GPU capability, a pointer (by mouse or touch screen) and a sound device are required.
The App offers remote play over a network so a TCP/IP interface is needed, ideally WiFi for full mobility, but the app will work in local mode if no network is available.
Persistent store is needed, no design decision has been made yet as to what form this will take, but it is likely to be Java serialization to local store.

4.3 Software Interfaces

The game uses a third party Chess Engine. Initial plans are to use Stock Fish [4] as it is widely regarded as a powerful Chess engine, it is open source, and the entire source is available on GitHum [5]. Stockfish is coded in C++, so the first challenge is to incorporate a C++ compiled module into Java bytecode, resources are available online to help with this, such as [6].
An alternative would be to use a Java chess engine, which would simplify development, resources are available from : [7].
Currently we expect to use the UCI chess interface, see reference: [3]. This is used by Stockfish and is a significant standard for chess engines.

4.4 Communications Interfaces

The App can play another similar app on a TCP/IP network segment that can be addressed by a direct IP address - that is, a local network segment but probably not across routers or firewalls.
The App will use Java TCP/IP Sockets to exchange small human-readable packets describing Chess moves and a limited Game protocol. Chess moves will be described using PNG or UIC, see Appendix C.

5 System Features

This section describes the requirements to be delivered in the product. The requirements are derived firstly from the Project Assignment , and from face to face interviews with Dr Mora, and from assumptions made by the development team. The source of each requirement is stated, with the priority for delivery of the requirement.

5.1 Player Profiles

The specification states *"• When someone calls the menu item "New game", the interface asks for the two types of players. There are three choices for white, and three choices for black obviously."* However selecting Network for both players makes no sense, one player must be local to the device, either 'Human' (the User), or Computer, the chess engine on the device. If network is selected, we will be playing another device - but is that device using a chess engine or a human player? To resolve these issues, we will split the players into **1st player - White** and **2nd player - Black**, with options for each as in table 2.

Table 2: White and Black player roles

1st player - White	**2nd player - Black**	Description
Human	Human	Two player (human) game on one device - take turns to play
Human	Computer	Human (the User) plays Chess engine on the local chess engine
Computer	Human	User plays Engine but Human plays as Black (2nd)
Computer	Computer	Chess engine plays itself, on local device (low priority, this may be technically challenging)
Human	Network	Human users plays another device over network. It is not known what the remote device is playing, Human or Engine
Network	Human	As above but Network plays White
Computer	Network	Local chess engine plays the network player
Network	Computer	As above but Network plays White
Network	Network	**Not valid**, one player must be local to the device

The requirements identified are:

Table 3: Player requirements

Number	**Requirement**	**Source**	**Priority**
REQ-P1:	The application must store at least 8 player profiles.	Spec	*High*
REQ-P2:	The profiles must be persisted without any user interaction and reloaded when the application starts.	spec	*High*
REQ-P3:	Profiles are local and specific to an individual device (i.e. there is no requirement to migrate profiles from one device to another)	Derived	*Medium*
REQ-P4:	The menu that allows a user to select the type of player must have quick access to player profiles	Spec	*Medium*
REQ-P5:	To start a game, the user may select from three types of player for White, *Computer, Human, Network*	Spec	*High*
REQ-P6:	To start a game, the user may select from three types of player for Black, *Computer, Human. Network*	Spec	*High*
REQ-P7:	The roles will be interpreted as in Table 2	Derived	*High*
REQ-P8:	The combination network::network will not be permitted.	Derived	*High*
REQ-P9:	When *Computer* is selected for either White or Black, the user will be able to select the level of play of the Chess engine	Spec	*Low*
REQ-P10:	When *Computer* is selected for either White or Black, the user will be able to select from a list of available Chess engines	Spec	*V Low*
REQ-P11:	The number of wins and losses will be stored for each player profile	Spec	*High*

5.2 Game

This section describes the requirements for playing the game. First a few notes on Chess notation. The columns of the board are described by letters 'a' - 'h' and referred as the file, while rows are described by numbers 1..8 and described as the rank. White is always at the bottom of the board, so all White pieces start in ranks 1 and 2. Standard notation is designed to be very abbreviated and rapid to write down for experienced players and commentators. The standard notation only records the type of piece and the square where it completes its move, but for Pawns, no piece type is used at all. A line of notation describes a White / Black move pair. Thus:
4a 6b
describes White moving a pawn two squares followed by Black moving a pawn 1 square , while
Na3 Bh6
describes White's Knight and Black's Bishop moving. Note that the starting square is not described at all, the reader must work this out from the state of the game board before the move is made.

Where two pieces could move to the same square, the starting Rank is specified, unless this is also ambiguous, in which case the starting File is specified. The notation is brief and concise but hard to calculate and quite hard to understand for a non-player. Therefore we have made a decision that the game will use Portable Game Notation [2] [8] or UIC [3] and this will be displayed on the play list. As it was developed for computer use, and is widely used in chess engines, it simplifies the coding task without reducing human readability to an unacceptable degree.

Table 4: Game requirements

Number	Requirement	Source	Priority
REQ-G1:	The Chess game must have a 2D board	Spec	*High*
REQ-G2:	The game must have a move list.	Spec	*High*
REQ-G3:	The Move list will show on a separate page and show all moves in the current game	Spec	*High*
REQ-G4:	The moves will be recorded and displayed in PGN [2] or UIC [3].	Spec	*Medium*
REQ-G5:	The move list can be displayed by a menu selection and / or an icon or button on the main chess page (to be decided at build time), but must be readily apparent to the user	Spec	*High*
REQ-G6:	The move list will enable scrolling if necessary	Spec	*Low*
REQ-G7:	The Move list can be exported in plain text format	Spec	*Low*
REQ-G8:	The game screen will show the names of the players eg local player profile, and as a minimum thge IP address of a Network player, or the name of the chess engine	Spec	*High*
REQ-G9:	The game screen will show a position score, based on the simple piece values shown in Figure 1 . No calculations will be made for any positional advantage, simply for the points of the pieces in play for each side.	Spec	*Medium*
REQ-G10:	For computer-computer games, the user will be asked to enter the number of games to be played.	Spec	*High*
REQ-G11:	For computer-computer games, the play changes sides each game.	Spec	*High*
REQ-G12:	For computer-computer games, the score of games won and lost will be displayed and updated at the end of each game	Spec	*High*
REQ-G13:	For games involving one or two computers, the play will be delayed to a defined time period (e.g. 5 seconds). This will be a system-wide constant value, but not changeable by the user (unless time permits to enable this feature).	Added	*Medium*
REQ-G14:	White always starts the game	Spec	*High*
REQ-G15:	The user can select one of her pieces by pointer (mouse or touch, depending on the device).	Spec	*High*
REQ-G16:	Once selected, the game board will highlight all squares to which the piece is permitted to move	Spec	*Medium*
REQ-G17:	OR if there are no legal moves for the piece, the piece selection will flash or otherwise indicate an invalid selection, and the piece will not be highlighted	Spec	*Low*
REQ-G18:	If the player has been checked, only moves that will uncheck the player are permitted (NB there must be at least one such move - otherwise it is CheckMate!)	Spec	*Low*
REQ-G19:	Each Human player shall have a button and/or menu option to re-sign.	Spec	*High*
REQ-G20:	The game will be able to receive a 'Resign' from a chess engine	Spec	*High*
REQ-G21:	The game is complete when either player resigns or either played is check-mated.	Spec	*High*
REQ-G22:	After completion the game remains displayed until the user selects 'New Game' via the game interface	Spec	*High*
REQ-G23:	The game will offer teh user a Help option, by button or menu or both. The Help display will be multi-page and provide the user with sufficient guidance that no separate user documentation is	Derived	*Medium*

Symbol					
Piece	pawn	knight	bishop	rook	queen
Value	1	3	3	5	9

Figure 1: Chess piece values

5.3 Network Play

The specification demands that the game can play with other games over a network, this section describes the requirements for this. The specification does not give much detail on how this is to be achieved, so this section makes several assumptions that must be agreed with the customer.

Table 5: Network requirements

Number	Requirement	Source	Priority
REQ-Net1:	The game must allow finding a network player from a given IP	Spec	*High*
REQ-Net2:	The application opens IP Port 4567 when starting and closes it when it exits (for network play)	Spec	*High*
REQ-Net3:	The network play only needs to work on the same subnet, no IP routing across routers or firewalls is needed.	Interview	*High*
REQ-Net4:	Active mode: The game starting a network game is said to be in Active network mode	Derived	*High*
REQ-Net5:	Active mode: If the user selects Network Game at game start, the application will ask for an IP address of another game.	Spec	*High*
REQ-Net6:	Active mode: Once an IP address is entered, the game will attempt to contact and connect to a game at that address.	Derived	*High*
REQ-Net7:	Only IP V4 will be used, no IP V6 support.	Derived	*Medium*
REQ-Net8:	Active mode: IP addresses will be entered the normal format of xxx:xxxx:xxxx:xxxx where each xxxx represents a 8 bit value in decimal notation, for example 192.168.135.33	Derived	*Medium*
REQ-Net9:	Active mode: If no response is received from the given IP address in a defined time, an error is displayed and the game state reverts to game-not-started.	Derived	*High*
REQ-Net10:	Active mode: The time-out will be a system global constant in the first release, and is not user configurable	Derived	*Low*
REQ-Net11:	Passive Mode: The game waiting to receive a network play partner id said to be in Passive mode.	Derived	*High*
REQ-Net12:	Passive Mode: At game start, the user can select Network game, Passive mode	Derived	*High*
REQ-Net13:	Passive Mode: The game will wait indefinitely for an incoming connection request on port 4567.	Derived	*High*
REQ-Net14:	Passive Mode: The user can cancel passive mode and return to the game-not-started state.	Derived	*High*
REQ-Net15:	Passive Mode: Once a connection is opened, the Active game sends player details, and the Passive game also responds with player details.	Derived	*High*
REQ-Net16:	After that, moves are exchanged until the game is complete or either played selects 'Stop Game'.	Derived	*High*

5.4 User Interface

In this Section, A demonstration of the software will be shown as below. In order to have Mock up, we used JAVA and JFC and Swing GUI[1]. According to Walrath, Kathy [2] "JFC is short for Java Foundation Classes, which encompass a group of features for building graphical user interfaces (GUIs) and adding rich graphics functionality and interactivity to Java applications. It is defined as containing the features shown in the table below." and Swing "Includes everything from buttons to split panes to tables. Many components are capable of sorting, printing, and drag and drop, to name a few of the supported features. " [9]

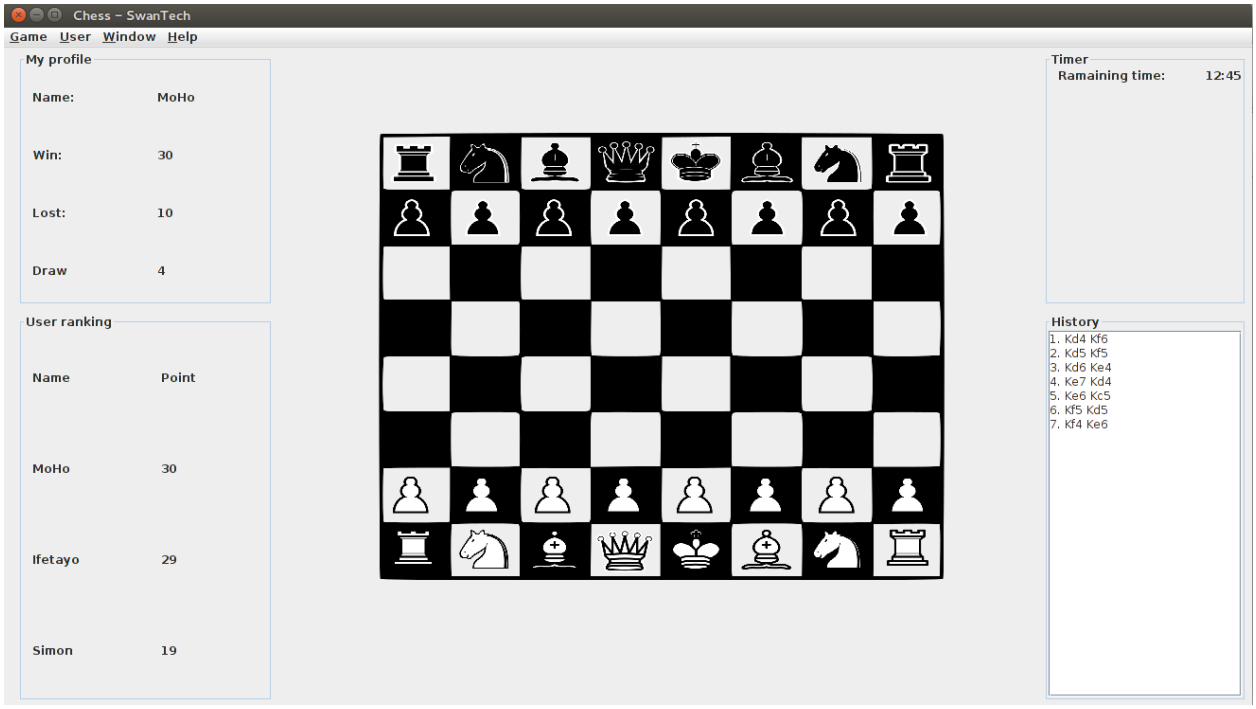

Figure 2: Whole interface will all panels

Above figure shows all aspect of the application. Menus, panels and board in the middle of the screen. The final project will be very similar to this figure.

[1]The hard code of this demo is available if it is needed.

[2]The same article is also available in Java JFC and Swing tutorial in Oracle website : `http://docs.oracle.com/javase/tutorial/uiswing/start/about.html`

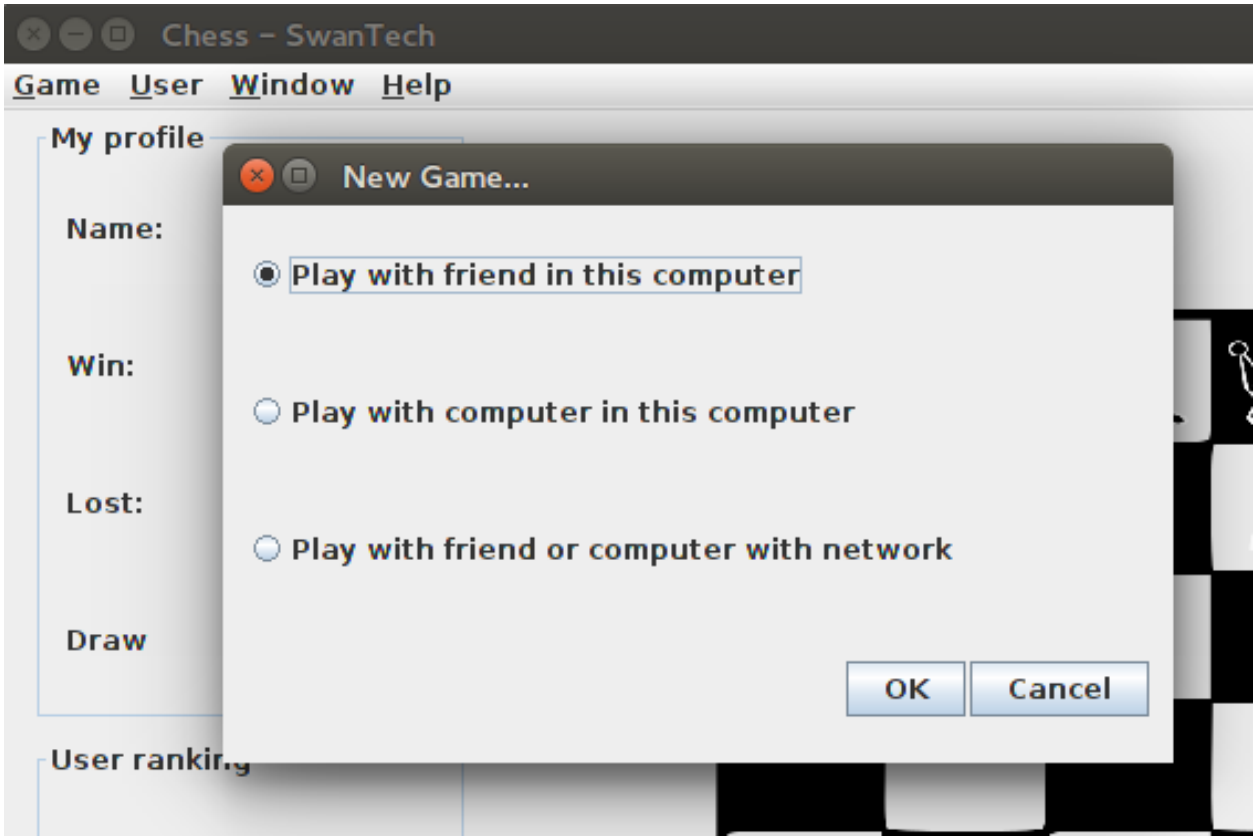

Figure 3: New game dialog

In this figure, when user try to start a new game, a dialog with three options comes to the screen and user should choose the type of game. The default option is play with friend in the curent computer. Depends on user choice the type of game will change.

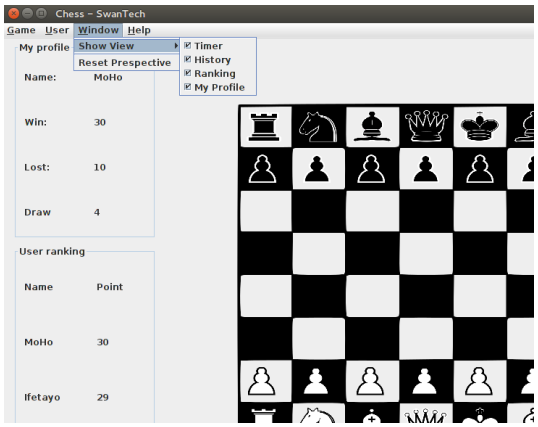

Figure 4: Available menu

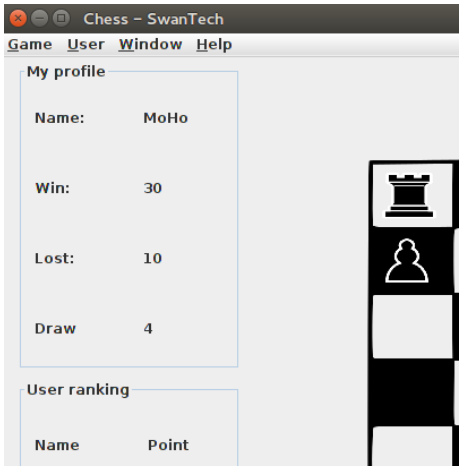

Figure 5: Sub Menus with functionality

These two pictures demonstrate the menu with functionality to show or hide panels in the program. They are all written by Swing and JMenu, JMenuItem and JCheckBoxMenuItem methods. There are also Mnemonic and Accelerator for necessary items in menu like shotcut key Ctrl+N is assigned for new game or Alt+G is for *Game menu* and so on.

6 System Design

6.1 Class Structure

6.2 UML Collaboration Diagram

6.2.1 Activity Diagram

According to Booch, Grady "Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the UML, activity diagrams are intended to model both computational and organisational processes. Activity diagrams show the overall flow of control." [10]
In this diagram(next page), some part of the system has been broken to *Call Activity Nodes* because of limit space in the page. First one on top, is about how to uncheck when the player is check. Second one, explain why a piece might be impossible to move. Next one is all possible movement and the last one is when a player is check and how can player should react when it is checked. To uncheck(if it is possible), the first call activity node is solution.

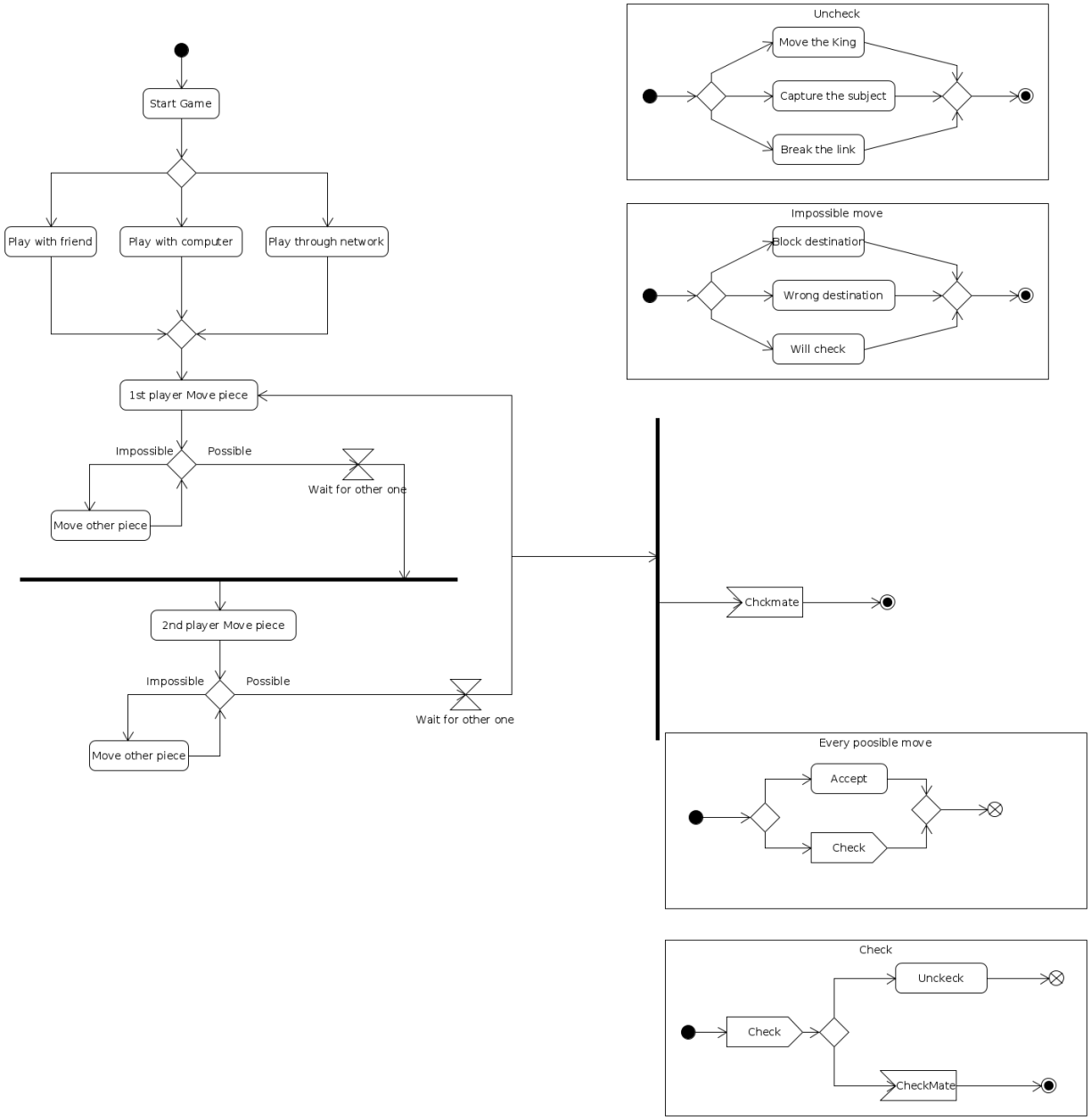

Figure 6: Project Activity Diagram

7 Other Non-functional Requirements

7.1 Technical Environment

This section describes the direct technical environment requirements derived from the specification.

Table 6: Non Functional requirements

Number	Requirement	Source	Priority
REQ-NF1:	The application must be runnable on Phones, Tablets and Computers	Spec	*High*
REQ-NF2:	The game does not have to run on IOS devices	Interview	*High*
REQ-NF3:	The game will run on Android tablets and phones	Derived	*High*
REQ-NF4:	The game will run on Windows and OS X PCs provided they can host the appropriate JVM	Interview	*High*
REQ-NF5:	It will be possible to use an alternative Chess Engine. It may be that a Java class has to be subclassed and modified to make this possible.	Interview	*High*

7.2 Performance Requirements

Many aspects of the game performance are beyond the control of the software team, such as:

- The performance of the device, from Phones to PCs
- The performance of the network
- The performance of the Chess engine

So we will give only limited assurances on performance.

Table 7: Performance requirements

Number	Requirement	Source	Priority
REQ-NF20:	The application will start and load its persistent data within 20 seconds	Spec	*High*
REQ-NF21:	From selecting a piece, legal moves will be displayed within 5 seconds	Interview	*High*
REQ-NF22:	From selecting a legal move, the other player move can commence within 5 seconds.	Derived	*High*

7.3 Safety Requirements

We can foresee no direct safety concerns in the application. Clearly as with all other computer games, they should not be used while driving or operating machinery.

7.4 Security Requirements

Within the limitations of a 10 unit module, particularly when we have only three team member for a project designed for five, we have decided that we will not implement any security requirements, and in particular:

- No user password will be required to play the game
- Game moves will be sent over the network in plaintext, including player names, profiles and scores
- No action will be undertaken to verify the identity of a remote network player
- Persistent player data will be stored in plaintext

We believe that as the game does not involve any payment and requires no personal detail, this is acceptable. Furthermore, network play is limited by the span of a local area network so it is unlikely that a player will really be able to play with another 'anonymous' player but will be someone they know or how is in sight. If the game were extended to a Internet enabled game, these limitations would not be acceptable.

7.5 Software Quality Attributes

Specify any additional quality characteristics for the product that will be important to either the customers or the developers. Some to consider are: adaptability, availability, correctness, flexibility, interoperability, maintainability, portability, reliability, reusability, robustness, testability, and usability. Write these to be specific, quantitative, and verifiable when possible. At the least, clarify the relative preferences for various attributes, such as ease of use over ease of learning.

8 Other Requirements

Define any other requirements not covered elsewhere in the SRS. This might include database requirements, internationalization requirements, legal requirements, reuse objectives for the project, and so on. Add any new sections that are pertinent to the project.

Appendices

A Glossary

B Analysis Models

Optionally, include any pertinent analysis models, such as data flow diagrams, class diagrams, state-transition diagrams, or entity-relationship diagrams.

Ifetayo - add Use Case models here??

C To Be Determined List

1. Use UIC or PNG for exchanging Chess move data?

References

[1] D. B. Mora, "M24 group project part ii a specifications and design document," assignment, Swansea University, Department of Computer Science, February 2015.

[2] S. J. Edwards, "Portable game notation specification and implementation guide," March 1994.

[3] April 2004.

[4] M. C. Tord Romstad and J. Kiiski, "Stockfish chess engine," 2015.

[5] "Stockfish github repository," February 2015.

[6] A. R. Rahul, "Stockfish port for java," February 2014.

[7] March 2015.

[8] "Portable game notation," 2015.

[9] K. Walrath, *The JFC Swing tutorial: a guide to constructing GUIs*, vol. 1. Addison-Wesley Professional, 2004.

[10] G. Booch, "Uml in action," *Communications of the ACM*, vol. 42, no. 10, pp. 26–28, 1999.