Chess Game System Design Document

Web-Based Chess Application

Document Version 2.0

Product Name: CheckMate

Last Updated: November 2024

Author: Jaimin, Werner, Flavio, Monica

Prepared By: Jaimin

Table of Contents

1. Introduction

1.1 Purpose

This document details the system design for a web-based chess application implemented using React and Java as backend. It serves as a comprehensive guide for development teams and collaborators.

1.2 Scope

The system consists a full-featured chess game with:

- Real-time multiplayer functionality
- Guest play mode
- Internationalization support
- Move validation
- Game state management

1.3 System Overview

The application follows a modified MVC pattern adapted for React, incorporating modern web development practices and microservices architecture.

2. Architectural Overview

2.1 Frontend Layer (View)

- User Interface Layer
  - Main container for React components
  - Modular component architecture
  - Responsive design implementation
- Core Components
  - Chess Component (Main controller)
  - Language Selector
  - Board Component
  - Piece Component

2.2 State Management (Model)

- Game State Management
  - React useState implementation
  - Immutable state updates
  - Centralized state control
- Language State
  - Translation key system

- Dynamic text rendering
- Language preference management

2.3 Backend Services (Controller)

- REST API Layer
- Game Logic Service
- Translation Service
- Database Integration

3. Component Architecture

3.1 Core Components

Detailed breakdown of main system components:

1. ChessGame Component
   - Game state management
   - Board display
   - Piece movement
   - Game initialization
   - Board data conversion
2. Chess Service
   - API communication
   - Session management
   - Move validation
   - State synchronization
3. Language Provider
   - Context management
   - Translation functions
   - Language switching

3.2 Service Layer

- RESTful API design
- Microservices architecture
- Scalable backend services

3.3 State Management:

- Centralized state management
- Immutable state updates
- Clear data flow patterns

3.4 Data Flow:

- Unidirectional data flow
- Event-driven architecture
- Clear service boundaries

4. Component Specifications

4.1 Frontend Layer (View):

- User Interface Layer: Main container for all React components • Components:
  - Chess Component: Main game controller
  - Language Selector: Handles language switching
  - Board Component: Manages chess board state
  - Piece Component: Individual chess piece logic

4.2 State Management (Model):

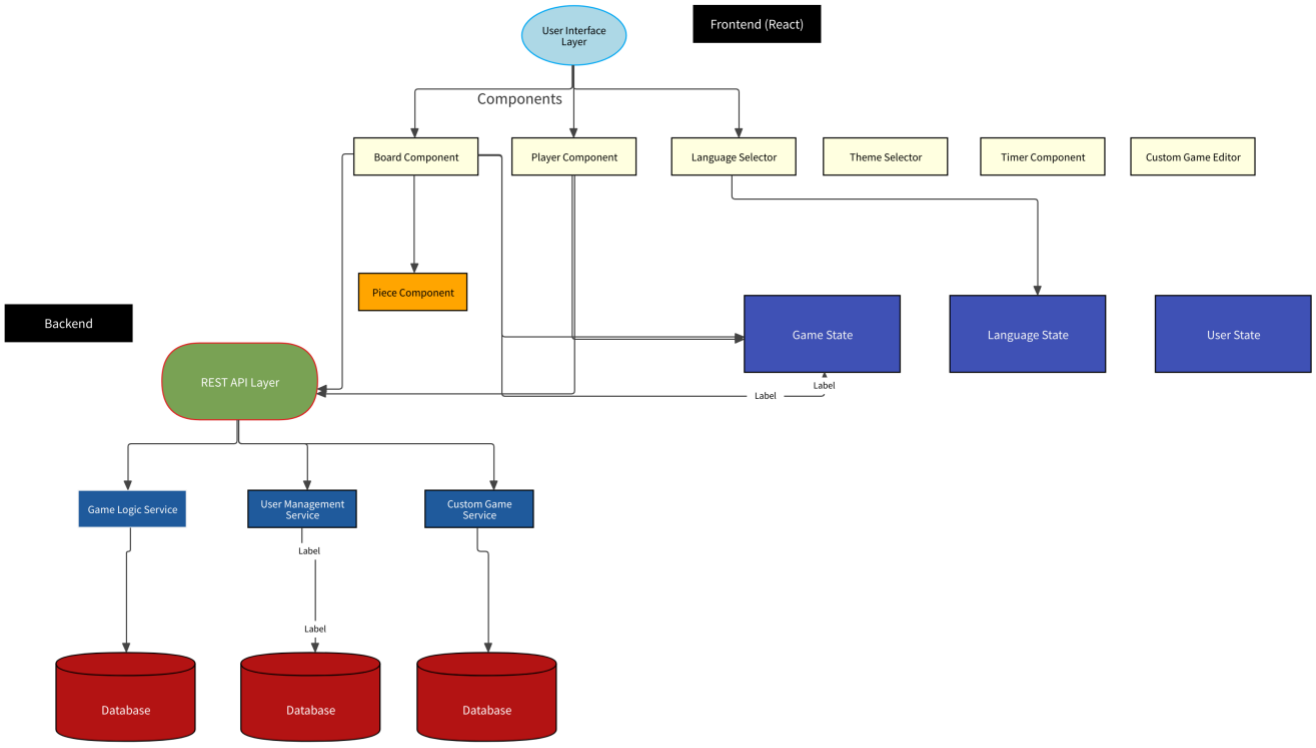
- Game State: Manages chess game state using React useState
- Language State: Handles language preferences and translations

4.3 Backend Services (Controller):

- REST API Layer: Handles communication between frontend and services
- Game Logic Service: Implements chess rules and validations
- Translation Service: Manages multilingual support
- Database: Stores game states and language data

5. CRC cards for Frontend and Backend Chess Logic

Software Architecture Design Diagram:



CRC Card Builder Page

CRC Card 1 **ChessGame**

Card Name	ChessGame		
Superclasses			
Subclasses	React.Component		
Responsibilities	Manages game state and board Handles piece selection and mov Updates board display Manages captured pieces Handles game initialization Updates board periodically Converts board data between for Renders chess board UI	Collaborators	ChessService LanguageProvider Board State Manager

CRC Card 2 **ChessService**

Card Name	ChessService		
Superclasses			
Subclasses			
Responsibilities	Handles API communication Starts guest game session Sends move commands Retrieves board state Manages game IDs	Collaborators	ChessGame Backend API

CRC Card 3 **LanguageProvider**

Card Name	LanguageProvider

Card Name	BoardStateManager
Superclasses	

Superclasses			
Subclasses			
Responsibilities	Provides language context Manages language state Provides translation function Switches between languages	Collaborators	ChessGame Translation Service

CRC Card 4 **BoardStateManager** **CRC Card 5** **MoveHandler**

Card Name	MoveHandler		
Superclasses			
Subclasses			
Responsibilities	Validates piece selection Processes move attempts Updates piece positions Tracks captured pieces Manages player turns	Collaborators	ChessGame ChessService

Card Name	GameStateManager		
Superclasses			
Subclasses			
Responsibilities	Tracks game session state Manages player IDs Handles error states	Collaborators	ChessGame ChessService

Subclasses			
Responsibilities	Initializes board array Converts piece representations Manages piece colors and types Handles captured pieces Converts API responses to UI for	Collaborators	ChessGame ChessService
	Updates game status Maintains current player turn		

CRC Card 6 **UIRenderer**

Card Name	UIRenderer		
Superclasses			
Subclasses			
Responsibilities	Renders chess board grid Displays piece images Shows captured pieces Handles square highlighting Displays game status Shows current player	Collaborators	ChessGame LanguageProvider

CRC Card 7 **GameStateManager**

CRC Card Builder Page

CRC Card 1 **Pawn**

Card Name	Pawn		
Superclasses	ChessPiece		
Subclasses			
Responsibilities	Represents each pawn piece Keeps track of moves made Defines its legal move Returns pathway of move	Collaborators	ChessBoard

CRC Card 2 **Rook**

Card Name	Rook		
Superclasses	ChessPiece		
Subclasses			
Responsibilities	Represents each rook piece Keeps track of moves made Defines its legal move Returns pathway of move	Collaborators	ChessBoard

CRC Card 3 **Knight**

Card Name	Knight
Superclasses	ChessPiece
Subclasses	

Card Name	Bishop		
Superclasses	ChessPiece		
Subclasses			
Responsibilities	Represents each Bishop piece	Collaborators	ChessBoard

	Keeps track of moves made Defines its legal move Returns pathway of move		
Responsibilities	Represents each Knight piece Keeps track of moves made Defines its legal move Returns pathway of move	Collaborators	ChessBoard

CRC Card 4 **Bishop CRC Card 5** **Queen**

Card Name	Queen		
Superclasses	ChessPiece		
Subclasses			
Responsibilities	Represents each Queen piece Keeps track of moves made Defines its legal move Returns pathway of move	Collaborators	ChessBoard

CRC Card 6 **King**

Card Name	King		
Superclasses	ChessPiece		
Subclasses			
Responsibilities	Represents each King piece Keeps track of moves made Defines its legal move Returns pathway of move	Collaborators	ChessBoard

CRC Card 7 **ChessPiece (abstract)**

Card Name	ChessPiece (abstract)
Superclasses	

Card Name	ChessBoard

Superclasses			
Subclasses			
Responsibilities	Contains the board and pieces Makes move on board Checks if input move is valid Keeps track of Kings in Check Contains the logic of the board Prints board and state of board	Collaborators	Chess
Subclasses	Pawn Rook Knight Bishop Queen King		
Responsibilities	Contains info of color and type Contains its move history Gets pathway for move	Collaborators	ChessBoard Chess

CRC Card 8 **ChessBoard**
CRC Card 9 **Chess**

Card Name	Chess
Superclasses	
Subclasses	

Card Name	Move		
Superclasses			
Subclasses			
Responsibilities	Represents coordinates on board Contains int row and column	Collaborators	ChessPiece Pawn Rook Knight

			Bishop Queen King ChessBoard Chess Controller
Responsibilities	Links ChessBoard and Controller Takes care of moves handling Keeps track of players turn Checks if game has ended Takes care of game state Gets winner of the game	Collaborators	ChessBoard Controller

CRC Card 10 **Controller**

Card Name	Controller		
Superclasses			
Subclasses			
Responsibilities	Creates the chess game Creates the player objects Interacts between player and gam	Collaborators	Player Chess

CRC Card 11 **Move**

CRC Card 12 **Placeholder**

Card Name	Placeholder		
Superclasses			
Subclasses			
Responsibilities	Represents tiles on the board Contains chess piece or an empt	Collaborators	ChessBoard ChessPiece

CRC Card 13 **Player**

Card Name	Player
Superclasses	

Subclasses			
Responsibilities	Reads inputs from players	Collaborators	Controller Chess

CRC Card 3 Theme Provider

Card Name			
Superclasses			
Subclasses			
Responsibilities	Provides theme context Manages theme state Provides coloring function Switches between themes	Collaborators	ChessGame Translation Service

CRC Card Builder Page

CRC Card 1 TimerMode

Card Name	TimerMode		
Superclasses			
Subclasses			
Responsibilities	Manage timer state Updates player times Handles time limit selection Manages game over by time	Collaborators	ChessGame GameState