Com S 430

Project

October 17, 2005
Project: .NET Texas Hold’em Poker

Overview

The aim of this project is to develop a distributed multiplayer Poker game using C# and the .NET Remoting infrastructure. The final application has to consist of two parts: a server that provides the basic logic to establish a Poker game and a Windows.Forms client, which implements an interface to the Poker game.

Both the server and the Windows.Form client have to be implemented in the same assembly (i.e., one application). At runtime, a player (i.e., the user) can decide whether to host a game or not. If a player chooses to host a game, then the player’s application will start a Remoting server (i.e., a Poker game server), so that other players can connect to it. The server has to provide two distinct functionalities:

- A discovery service that allows clients on the Internet to find other players and one or more game hosts, respectively.
- A Poker table that has at least 5 seats and a dealer, which controls the game. The dealer is a virtual player that must not participate in the game. Its sole purpose is to run the game (i.e., deal cards, start the betting rounds, and to identify the winner of a round).

Texas Hold’em Poker

Texas Hold'em is the most popular form of casino Poker. Texas Hold'em is easy to learn, but it boasts intricate strategy and requires practice, skill and cunning to play well.

Poker is a round-based game. In Texas Hold'em, there are two facedown cards for each player and five face-up community cards. The player who makes the best five-card Poker hand with any combination of their two facedown cards and the five community cards wins the round.

In a Texas Hold'em game, a marker, called dealer button, is used to indicate, which player is the "dealer" for the current round. In this project, we use a “virtual” dealer, that is, no player can actually be the dealer. Thus, the server retains control over the game, but elects a leader for the current round. The leader will always be the player left of the dealer.

There are no antes in Hold'em, instead, forced bets called blinds are used. Before the cards are dealt, the player to the left of the dealer posts a bet called the small blind, which is usually equal to half of the minimum bet. The player to the left of the small blind posts the big blind, which is equal to the minimum bet. The first two cards are dealt to each player face down. These cards are called the hole cards, and the player to the left of the big blind starts the first round of betting. Note that the small blind and big blind do not get to look at their cards before betting, thus the term "blind". In the first round of betting, each player has three options: call, raise or fold. To call, the player must place a bet that is equal to the last bet placed. (For the first player in the round, this would be equal to the minimum bet.) A Player may choose to raise his/her call bet.
by an additional amount, which the other players will then have to call. If one's hole cards are not favorable, the player may simply choose to fold and sit out the round.

After all the players have finished the first round of betting, the first three community cards are dealt face-up on the board. This is called the *flop*. The second and all subsequent betting rounds start with the first player to the dealer's left. All players have now an additional option: *check*. By checking, the player indicates interest in the pot without placing a bet. Any player may choose to place a bet, which the other players must then call, to raise, or to fold.

After the second betting round, the fourth community card is dealt face-up. This card is called the *turn* card. We use “No Limit Hold'em”, that is, the maximum bet is determined by the remaining credits of a player. After the third betting round, the fifth and final community card, called the *river* card, is dealt, which is followed by a final betting round. Afterwards each player turns his/her hole cards face up. The highest hand that can be made with any combination of a player's hole cards and the five community cards wins the pot. If two or more players have the same hand, the next highest card in the player's hand (the *kicker*) is used to break a tie. The dealer mark is then passed clockwise to the next player and another round of play begins.

**Graphical Overview**

- There is a marker called the dealer button that indicates to position of the dealer. Action is always initiated to the left of the dealer and continues in a clockwise manner.

![Graphical Overview](http://www.online-poker-rules.com/texas_hold_em_rules.php)

- Before the cards are dealt the two players to the left of the dealer place initial bets called the *small blind* and the *big blind* in order to create a pot to play for. The small blind places a bet equal to half the minimum bet, and the big blind places a bet equal to the minimum bet.

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Each player is dealt two cards called *hole cards*, which should not be revealed to the other players. At a later stage five community cards will be dealt face-up in the center of the table - each player must make their best possible 5 card poker hand using any 5 of the 7 cards they can see (their 2 hole cards and the 5 community cards).

Because the small and the big blinds have already started the pot, the player to the left of the big blind is the first to bet. Each player has these options:

- **FOLD** - Throw in their hand and sit out the round.
- **CALL** - Make a bet equivalent to the last bet - at the start of the game the “last” bet placed was by the big blind.
- **RAISE** - Make a bet equivalent to the last bet plus an additional bet.

Betting continues in a clockwise manner until all players remaining in the game/round have an equivalent stake in the pot.

After the initial betting round, three community cards are dealt face-up in the center of the table. This is called the “flop” and can be used by all players to make up their hand. The player left of the dealer starts the second betting round. Now, all players have an additional betting option called “check”.

- **CHECK** - If no bets have been made then the player can opt to make no bet and control is then passed onto the player to their left.
- At the end of the second betting round the fourth community card is dealt which is called the “turn”. The player left of the dealer starts the third betting round.

- After the third betting round is finished the fifth and final community card is dealt, this is called the “river”. The player left of the dealer starts the final betting round.

- Once the final betting round is complete the remaining players must show their cards to see who wins the pot. The player left to the dealer must first show his/her cards and then all remaining players, in order, can opt to fold or show their cards. The player with the highest 5 card Poker hand made up from his/her 2 hole cards and the 5 community cards wins the pot.
No Limit Hold’em

- Minimum raise:
  The minimum raise is equal to the small blind.

- Blind increments:
  The forced bets (i.e., small and big blinds) are incremented every 10-20 rounds to force the players to actually play more games.

- All-in:
  In No Limit Hold’em, there is no maximum limit for a bet. However, a player can only bet as much as he/she owns in chips. A player can move “all-in” any time in the game. The goal of moving all-in is to “double up”. A player can raise “all-in”. In this case, the game continues as usual. However, we need to consider two unique situations.
    - First, if only one player calls, then there are no additional betting rounds anymore. Both players have to show their hole cards (i.e., put the cards face up in the middle of the table). Then the remaining community cards are dealt and the winner is determined. If the all-in player loses, then he/she is “out”, that is, he/she has to leave the game.
    - Second, if more than one player calls, then those players can continue to bet against each other. In this situation, a so-called side pot is created. The all-in player is not eligible for the side pot. If the all-in player wins, then the side pot is returned to the other players.

A player can call “all-in”. In this case, the player puts his/her remaining chips into the pot. If the all-in player has fewer chips than required to match the current bet, then the current bet is reduced to the all-in player’s remaining chips. In this case, the supernumerary chips are returned to the other players. Remember, all players have to have the same stakes in the game.

Finally, a player can be automatically “all-in”, if his/her remaining chips are less than the small or big blind, respectively.
Cards & Hands

Standard Poker uses a pack of 52 playing cards. No two cards can have the same value. There are four suits: Club, Diamond, Heart, and Spade. Each suit has thirteen individual cards: 2, 3, 4, 5, 6, 7, 8, 9, 10, Jack, Queen, King, and Ace. We define the following order over cards:

\[
2 < 3 < 4 < 5 < 6 < 7 < 8 < 9 < 10 < \text{Jack} < \text{Queen} < \text{King} < \text{Ace}
\]

For example:

\[
\begin{array}{c}
\text{2} \\
\text{J} \\
\text{K} \\
\text{J}
\end{array}
\]

is smaller than

\[
\begin{array}{c}
\text{3} \\
\text{Q} \\
\text{Q} \\
\text{J}
\end{array}
\]

whereas

\[
\begin{array}{c}
\text{Q} \\
\text{J} \\
\text{Q} \\
\text{J}
\end{array}
\]

is greater than


Ranking of Poker Hands

1. Royal Flush: A straight to the Ace in the same suit. No two hands can have a royal flush at the same time.

2. Straight Flush: A straight in the same suit. In case of a tie, that hand with the higher-ranking “Straight Flush” wins.

3. Four of a Kind: Four cards of the same number. In case of a tie, the hand with the higher-ranking “Four of a Kind” wins.

4. Full House: “Three of a Kind” with any pair. In case of a tie, the hand with the higher-ranking “Three of a Kind” wins.

5. Flush: 5 cards of the same suite. In case of a tie, that hand with the higher-ranking card wins.

6. Straight: 5 cards with consecutive numbers. In case of a tie, that hand with the higher-ranking card wins.

7. Three of a Kind: Three cards of the same number. In case of a tie, the hand with the higher-ranking “Three of a Kind” wins.

8. Two Pair: Any pair with any pair. In case of a tie, the hand with the higher-ranking pair or the highest-ranking card wins.

9. Pair: A pair of any two cards with the same number. In case of a tie, the hand with the higher-ranking pair or the highest-ranking card wins.

10. Highest Card: A hand that does not even qualify for “Pair”. The hand, which is holding the highest-ranking card, wins.
Application Requirements

The server has to register a server-activated factory Remoting object with the .NET Remoting services. The SAO will use a HTTP-channel that will listen at port 9000. The class that implements the dealer has to be derived from MarshalByRefObject. Additionally, the server has to provide a discovery service located at port 9001. The discovery service is a Socket-based process that will respond to broadcast requests. If the server receives a broadcast request at port 9001, then the server has to send a packet at port 9002 to the sender that contains game-specific information (e.g. remote object URI, the server's hostname and IP, the number of available seats, etc.). Finally, the server has to provide support for a game chat room. That is, while the server is running, players should be able to exchange messages. To facilitate the implementation of the discovery service use UdpHostLocator library.

The Poker player logic, that is the client, has to be implemented in a Windows.Form GUI. The client is event-based. That is, the client has to react on Windows events, dealer events, Remoting events, and chat events. A client has to register with the server in order to participate in the game. The player that is assigned the first seat one will be the leader. The leader can ask the dealer to start the game. Note if the players are not ready yet, then it makes no sense to start a round at all. The leader changes after every round. That is, a new leader will be elected in a clockwise manner before a new round. The new leader will mark the position of the dealer for the round.

When a player registers with the server, the server will assign the initial credit to this player. The initial credit may be a default value or an existing balance that has been stored in a database. The latter optional approach will enable a scheme in which a player can keep his/her credit over time, and more importantly the server may grant players a loan in order to continue to play. Loans have to be repaid, may have attached an interest rate, and may have other effects on players like an imposed raise limit.

Policies, Rules, and Constraints

You can use everything that has been shown in class or was part of an assignment. Every student has to work on his/her own project, but the discussion of ideas is allowed. Note, however, that your solution must be original. That is, it must reflect your own ideas and work.

You have to document your project. That is, you have to write a report that will contain:

- A requirement specification,
- A design specification,
- Charts that illustrate the interactions between dealer and player and players in general,
- Discussion of special features of your application, and
- Open problems and possible future work.

The report should consist of approximately 20-25 pages.
What Is Important?

Presentation Checklist:

- Submit your project on time!
- Have all existing flow charts and sequence diagrams ready?
- Have your (draft) report ready.
- Be ready to explain the event handling.
- Be ready to explain parts of the source code.
- Check for an appropriate structure of the code, libraries, and executables.
- Check the functionality:
  - Is chat available?
  - Is the Poker logic correctly implemented?
  - Does the application freeze at any time?
  - Do you handle any unexpected behavior (e.g., a client disappears, you run out of credits, etc.)?
  - Is the GUI well structured? That is, how much time is needed to play the game the first time, without having to read the user documentation?
- Are there any extra features? Be ready to present them.

Report Checklist:

- Are the basic requirements covered?
- What are the additional requirements that you have identified?
- What are the requirements that you have changed?
- Is the specification complete with respect to the required functionality?
- Is the presentation well structured?
- Have you included prototypes, screen shots, UML diagrams, flow charts, sequence diagrams, etc.?
- Have you highlighted the special features of your application?
- Have you explained the basic design principles (that is, main program entities, classes, libraries, etc.)?
- What are the open problems?
- What are the possible future extensions?
- Have you added any extra features?
Milestones

Announced in class.

Deliveries

- Milestone results
- A package (ZIP-file) that contains both the applications and the source code.
- A written report.

Important Dates

- 11/07-11/11: Lab-session - project prototype presentation
- Friday, December 02, 2004: Submission of the project package.
- 12/05-12/09: Lab session - project presentation
- Friday, December 09, 2005: Submission of the written report.