

COMMON DESIGN DOCUMENT

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Abstract

This document contains information about all common aspects to the multiplayer ping pong game

1 State Abstraction

1.1 What is the state that is communicated ?

If a server maintains state, it means that the server maintains information about all of the current connections with its clients and the communications sent between them. Otherwise, the server application has no method to determine if the client intends to communicate further, is done communicating, is waiting for a response, or has experienced an error. We can define our states broadly in the following categories:

1. Initial State: When the server begins a session for the client, and assigns him a player id, conveys basic information about the gameplay etc.
2. Active State: When the client is playing the game on the server and so is “active”.
3. Disconnected State: When the client was playing the game earlier but is disconnected from the network due to network issues.
4. Aborted State: When the client was playing the game and then he aborted his application on his terminal in using a SIGINT .

1.2 What happens if a host goes down ?

Say host M goes down. Now the server shall have no information as to the activities of the player on M . However the gameplay for the remaining of the players shall not be disturbed by this activity. For the remainder of the players the gameplay shall continue with the player on machine M being replaced by a player controlled by the computer. This automated pseudo player shall have the same probability of hitting the ball with the paddle as the human playing on computer M .^{1 2}

1.3 What happens if a host is temporarily unavailable ?

Say host N is temporarily available, then we shall replace host N by an automated player having the same hit probability as the player who was playing on N . His score shall be edited as per his shots and so the gameplay shall not be affected at all for the remainder of the players. However as soon as the host shall be available, the human on N shall take up the position where the automated player left him.

¹For each human player we shall be computing the probability with which he/she successfully hits the ball and storing it as an attribute of the player.

²For an automated player the probability with which it hits the ball shall be an attribute which the user can modify via appropriate menu

2 Communication over the network

2.1 Protocol

TCP\IP protocol over IPv4 will be used for communication between multiple computers

2.2 Algorithm

Let the total number of players be N We shall be using multiple sockets for the server and a socket per player on every client computer. The server shall have a total of $N + 1$ sockets. ³ Steps to be performed for the initialisation of communication across the network:

1. On the server computer the application is started and it negotiates with the Operating system over the port to be used.
2. The application begins listening for incoming requests over the network(ie it uses a passive socket)
3. Work with the `sockaddr_in` structure: ⁴
4. `setsockopt` will be used to set settings to keep socket alive for the entire game ⁵We shall keep the socket open until the connection at the other end is closed by defining `linger` to be zero.

2.3 sending data

Since TCP sends data as a stream we shall add markers to the beginning and end of each message to alienate it from the previous and next message.

³With the extra socket, the server can handle a request from a client while still accepting more connections from other clients. The one extra socket shall be closed as soon as the initialisation process is complete

⁴this contains both the IP addresses and protocol port number.

⁵linger is a parameter that determines whether a socket waits to see that all data is read once the other end of the communication closes.

3 Regression Testing

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3.1 Use of preprocessor macros :

Preprocessor macros will be used to selectively compile code. We will have a macro NDEBUG which will be defined if the application is running in the non - debug mode.

3.2 Use of assert function :

The assert function will be used to effectively trackdown bugs and also checkfor invalid conditions at several steps in the code. ⁷

1. check if any of the thread id 's are NULL.
2. check if any coordinate that is being displayed is outside the game field.

3.3 Automated tests:

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1. Indefinitely carrying on game
 - (a) two player game
 - (b) players can be on the same or different computer
 - (c) initial velocity of the ball in the x-direction is kept zero and y direction velocity is set arbitrarily.
 - (d) Expected Result: ball never goes out of the court if the initial y coordinate of the ball lies between the extreme y coordinates of the two paddles ⁹
2. Ball never touches paddle
 - (a) 2 players
 - (b) players can be on the same or different computer.
 - (c) The ball is given a random velocity in the x direction .
 - (d) Expected Result:Ball never hits paddle.
3. Imperfect player vs perfect players:
 - (a) 2,3,4 player game
 - (b) number of balls can be 1,2,3

⁶separation of the main game and preliminary input The main game and the inputs that need to be taken from the user will be separate programs. The main game will basically take input via the command-line arguments (or 'argc').This will allow automation in the testing process .

⁷Assert function is disabled if the macro NDEBUG is defined

⁸The protocols used to transfer any files between connected machines will be ftp (port 21) and telnet (port 23)

⁹If the behaviour is expected to continue for an indefinite period of time,then we would check that the behaviour of the system is the same as expected for a fixed period of time

- (c) Players can be on the same computer or different computers. Different combinations present.
- (d) Expected Result: The imperfect player loses