Description of Classes:

1. For TCP Implementation

I.1 Server:

There are 3 classes:

I.1.A Server.java

Properties:

I.1.A.1 Main function: It spawns the coordinator thread that receives client messages. Afterwards it continuously determines the coordinate pairs of objects that have a timestamp difference of at most 100 ms and distance less than 10 units by calling the display function.

I.1.A.2 display(): It comes up with coordinate pairs and sends it the ConstructString function to determine whether to display the coordinates or not. To avoid repetitive print of the same coordinates, it waits for an update by calling the waitForUpdate function.

I.1.A.3 waitForUpdate(): It goes through an infinite loop until it detects messages from the client.

I.1.A.4 ConstructString(): By calculating the difference in timestamp and distance between the coordinate pairs, this function determines whether to display the coordinate pairs.

I.1.A.5 getDistance(): It is called from the ConstructString function. It returns the distances between the coordinates supplied by the ConstructString().

I.1.B ServerCoordinator.java

Properties:

I.1.B.1 Constructor ServerCoordinator: It accepts an ArrayList of ServerThreads.

I.1.B.2 run(): When the thread starts, it calls the waitForClients function.

I.1.B.3 waitForclients: In this function it creates a ServerSocket on port 4444. Then it continuously waits for clients. If a client requests connection, the ServerCoordinator spawns a thread to handle that particular client. Tha thread is then added to the ArrayList of ServerThread.

I.1.C ServerThread.java

Properties:

I.1.C.1 ServerThread Constructor: It receives the socket to connect with the client and client ID from ServerCoordinator.

I.1.C.2 run(): It initializes the input and output streams. Then, it sends the client its ID. Once, the ID is received by the client, the thread waits for coordinate updates from the client.

I.1.C.3 sendClientID(): It constructs a string that contains the client ID and sends it to the client.

I.1.C.4 reciveFromClient(): Using an InputStream, it reads in messages from its client. It then calls the process() function to extract information from the message.

I.1.C.5 process(): It tokenizes the message from client to extract the coordinates of the client.

I.2 Client:

Client.java:

I.2.A.1 main(): Creates a socket on port 4444. Then, the input and output streams are initialized. Afterwards, the received and moveAround functions are called.

I.2.A.2 receiveID(): The client reads the input stream to receive its ID.

I.2.A.3 moveAround(): The function loops forever. Within it, the function calls the generateRandomNumber function. It then constructs the string to send to the server. After calling the sendMessage function, the client sleeps for oe second before generating another random number.

I.2.A.4 generateRandomNumber(): It generates random number for the coordinates of the client.

I.2.A.5 constructMessage(): This returns a String that contains a header update, the client ID, the timestamp, and the client’s coordinates.

I.2.A.6 sendMessage(): Uses the output stream to send the client’s message to the server.

1. For UDP Implementation

II.1 Server:

There are 3 classes:

II.1.A Server.java

Properties: Does the same as described in I.1.A.

II.1.B ServerCoordinator.java

Properties:

II.1.B.1 run(): When the thread starts, it calls the waitForClients function.

II.1.B.2 waitForclients: In this function it creates a DatagramSocket on port 4444. Then it continuously waits for a DatagramPacket. If the message contains “request”, then the coordinator spawns a ServerThread, which is then added to the ArrayList of ServerThreads. If the message contains “update”, then the coordinator sends the message to the ServerThread.

II.1.C ServerThread.java

Properties:

II.1.C.1 ServerThread Constructor: It receives the socket to connect with the client, DatagramPacket, and client ID from ServerCoordinator.

II.1.C.2 run(): It calls the sendClientID() and recieveFromClientID() functions.

II.1.C.3 sendClientID(): It constructs a string that contains the client ID. The string is then converted to bytes and sent to the client.

II.1.C.4 reciveFromClient(): It waits for packets from client. It then calls the process() function to extract information from the message.

II.1.C.5 process(): It tokenizes the message from client to extract the coordinates of the client.

II.2 Client:

II.2.A Client.java:

II.2.A.1 main(): Creates a DatagramSocket. The functions sendRequest(), receiveID(), and moveAround() are then called.

II.2.A.2 sendRequest(): It creates a message containing the string ”request ” and converts it to bytes to send to the server.

II.2.A.3 receiveID(): The client waits for the packet from server containing its ID and converts it to integer.

II.2.A.4 moveAround(): It does as described in I.2.A.3.

II.2.A.5 generateRandomNumber(): It does as described in I.2.A.4.

II.2.A.6 constructMessage():It does as described in I.2.A.5.

II.2.A.7 sendMessage(): Converts the message into bytes and sends it to the server.

The system my program was compiled and built on Netbeans 6.9.1, and it was tested and ran on Windows XP.

State of Implementation

Client sends request to connect with the server. The server coordinator thread receives the request and spawns a thread that will handle that particular client. The coordinator sends the server thread its client’s ID. The client Id is then sent to the client. Once the client receives its ID, it sends coordinates including the header and timestamp to the server thread that was assigned to the client. The server receives the message and processes it. The server’s main class determines the coordinate pairs that must be displayed.

Test Strategies:

First, the server side was started. Then, multiple clients ran. The results are shown below.

Server Side:

C:\Documents and Settings\SMART User>java -jar "F:\OS\Project3\UDPProject3\UDPServer\dist\UDPServer.jar"

handling client 1

clientID to send to client:1

1

reading message from client

client #1: 5 26 66 1292178206608

client #1: 48 33 99 1292178207608

client #1: 16 5 33 1292178208608

client #1: 32 8 24 1292178209608

handling client 2

clientID to send to client:2

2

reading message from client

client #1: 12 98 66 1292178210608

client #2: 55 7 29 1292178211123

client #1: 93 30 78 1292178211608

client #2: 63 38 48 1292178212123

client #1: 21 42 92 1292178212608

client #2: 68 35 14 1292178213123

client #1: 49 67 65 1292178213608

client #2: 14 90 32 1292178214123

client #1: 63 65 27 1292178214608

client #2: 55 21 31 1292178215123

client #1: 36 87 45 1292178215608

client #2: 84 50 28 1292178216123

client #1: 55 25 65 1292178216608

client #2: 41 48 89 1292178217123

client #1: 11 95 62 1292178217608

client #2: 57 90 24 1292178218123

client #1: 2 13 92 1292178218608

client #2: 27 65 16 1292178219123

client #1: 29 57 23 1292178219608

client #2: 87 68 37 1292178220123

client #1: 59 41 62 1292178220608

client #2: 79 81 20 1292178221123

client #1: 25 18 5 1292178221608

client #2: 91 80 41 1292178222123

client #1: 3 22 29 1292178222608

client #2: 2 83 40 1292178223123

client #1: 46 8 6 1292178223608

client #2: 8 98 21 1292178224123

client #1: 50 3 22 1292178224608

client #2: 59 62 78 1292178225123

client #1: 59 87 78 1292178225608

client #2: 41 76 60 1292178226123

client #1: 91 48 46 1292178226608

client #2: 42 47 19 1292178227123

client #1: 75 87 59 1292178227608

client #2: 47 44 3 1292178228123

client #1: 43 9 97 1292178228608

client #2: 15 51 37 1292178230123

client #2: 93 86 72 1292178232123

client #2: 44 90 45 1292178234123

client #1: 54 90 85 1292178234608

client #2: 41 3 74 1292178235123

client #1: 76 58 98 1292178235608

client #2: 91 40 90 1292178236123

client #1: 78 99 77 1292178236608

client #2: 51 57 69 1292178237123

client #1: 20 74 61 1292178237608

client #2: 56 67 18 1292178238123

client #1: 25 68 69 1292178238608

client #2: 26 71 39 1292178239123

client #1: 31 76 76 1292178239608

client #2: 65 41 6 1292178240123

client #1: 69 57 31 1292178240608

client #2: 23 77 62 1292178241123

client #1: 51 79 90 1292178241608

client #2: 25 75 54 1292178242123

client #1: 35 38 65 1292178242608

client #2: 42 27 82 1292178243123

client #1: 50 44 30 1292178243608

client #2: 35 21 13 1292178244123

client #1: 9 85 40 1292178244608

client #2: 76 19 54 1292178245123

client #1: 88 79 69 1292178245608

client #2: 51 97 79 1292178246123

client #1: 22 82 44 1292178246608

client #2: 64 13 15 1292178247123

client #1: 45 61 61 1292178247608

client #2: 75 68 90 1292178248123

client #1: 65 32 70 1292178248608

client #2: 41 94 72 1292178249123

client #1: 2 18 41 1292178249608

client #2: 26 65 99 1292178250123

client #1: 73 17 63 1292178250608

client #2: 64 78 85 1292178251123

client #1: 6 72 100 1292178251608

client #2: 36 44 59 1292178252123

client #1: 64 19 51 1292178252608

client #2: 1 91 62 1292178253123

client #1: 10 23 53 1292178253608

client #2: 45 81 24 1292178254123

client #1: 41 95 27 1292178254608

client #2: 21 7 88 1292178255123

client #2: 65 9 36 1292178257123

client #1: 62 14 18 1292178257608

client #2: 68 61 42 1292178258123

client #1: 58 100 76 1292178258608

client #2: 51 31 53 1292178259123

client #1: 46 8 52 1292178259608

client #2: 46 1 16 1292178260123

client #1: 94 89 58 1292178260608

client #2: 44 8 92 1292178261123

client #2: 73 79 38 1292178262123

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Client #1:

C:\Documents and Settings\SMART User>java -jar "F:\OS\Project3\UDPProject3\UDPClient\dist\UDPClient.jar"

request

client ID:1

update 1 1292178206608 5 26 66

update 1 1292178207608 48 33 99

update 1 1292178208608 16 5 33

update 1 1292178209608 32 8 24

update 1 1292178210608 12 98 66

update 1 1292178211608 93 30 78

update 1 1292178212608 21 42 92

update 1 1292178213608 49 67 65

update 1 1292178214608 63 65 27

update 1 1292178215608 36 87 45

update 1 1292178216608 55 25 65

update 1 1292178217608 11 95 62

update 1 1292178218608 2 13 92

update 1 1292178219608 29 57 23

update 1 1292178220608 59 41 62

update 1 1292178221608 25 18 5

update 1 1292178222608 3 22 29

update 1 1292178223608 46 8 6

update 1 1292178224608 50 3 22

update 1 1292178225608 59 87 78

update 1 1292178226608 91 48 46

update 1 1292178227608 75 87 59

update 1 1292178228608 43 9 97

update 1 1292178229608 47 69 48

update 1 1292178230608 41 13 89

update 1 1292178231608 85 71 85

update 1 1292178232608 22 35 99

update 1 1292178233608 66 14 73

update 1 1292178234608 54 90 85

update 1 1292178235608 76 58 98

update 1 1292178236608 78 99 77

update 1 1292178237608 20 74 61

update 1 1292178238608 25 68 69

update 1 1292178239608 31 76 76

update 1 1292178240608 69 57 31

update 1 1292178241608 51 79 90

update 1 1292178242608 35 38 65

update 1 1292178243608 50 44 30

update 1 1292178244608 9 85 40

update 1 1292178245608 88 79 69

update 1 1292178246608 22 82 44

update 1 1292178247608 45 61 61

update 1 1292178248608 65 32 70

update 1 1292178249608 2 18 41

update 1 1292178250608 73 17 63

update 1 1292178251608 6 72 100

update 1 1292178252608 64 19 51

update 1 1292178253608 10 23 53

update 1 1292178254608 41 95 27

update 1 1292178255608 80 92 70

update 1 1292178256608 30 16 12

update 1 1292178257608 62 14 18

update 1 1292178258608 58 100 76

update 1 1292178259608 46 8 52

update 1 1292178260608 94 89 58

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Client #2

C:\Documents and Settings\SMART User>java -jar "F:\OS\Project3\UDPProject3\UDPClient\dist\UDPClient.jar"

request

client ID:2

update 2 1292178210123 71 22 19

update 2 1292178211123 55 7 29

update 2 1292178212123 63 38 48

update 2 1292178213123 68 35 14

update 2 1292178214123 14 90 32

update 2 1292178215123 55 21 31

update 2 1292178216123 84 50 28

update 2 1292178217123 41 48 89

update 2 1292178218123 57 90 24

update 2 1292178219123 27 65 16

update 2 1292178220123 87 68 37

update 2 1292178221123 79 81 20

update 2 1292178222123 91 80 41

update 2 1292178223123 2 83 40

update 2 1292178224123 8 98 21

update 2 1292178225123 59 62 78

update 2 1292178226123 41 76 60

update 2 1292178227123 42 47 19

update 2 1292178228123 47 44 3

update 2 1292178229123 31 35 73

update 2 1292178230123 15 51 37

update 2 1292178231123 78 78 96

update 2 1292178232123 93 86 72

update 2 1292178233123 84 91 7

update 2 1292178234123 44 90 45

update 2 1292178235123 41 3 74

update 2 1292178236123 91 40 90

update 2 1292178237123 51 57 69

update 2 1292178238123 56 67 18

update 2 1292178239123 26 71 39

update 2 1292178240123 65 41 6

update 2 1292178241123 23 77 62

update 2 1292178242123 25 75 54

update 2 1292178243123 42 27 82

update 2 1292178244123 35 21 13

update 2 1292178245123 76 19 54

update 2 1292178246123 51 97 79

update 2 1292178247123 64 13 15

update 2 1292178248123 75 68 90

update 2 1292178249123 41 94 72

update 2 1292178250123 26 65 99

update 2 1292178251123 64 78 85

update 2 1292178252123 36 44 59

update 2 1292178253123 1 91 62

update 2 1292178254123 45 81 24

update 2 1292178255123 21 7 88

update 2 1292178256123 87 67 100

update 2 1292178257123 65 9 36

update 2 1292178258123 68 61 42

update 2 1292178259123 51 31 53

update 2 1292178260123 46 1 16

update 2 1292178261123 44 8 92

update 2 1292178262123 73 79 38

update 2 1292178263123 64 65 78

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