DESIGN MILESTONE

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DATATYPE DESIGN

- Server-side:
  - WhiteboardServer
    * has a list of Whiteboards
    * sends and receives messages to/from clients, creating and modifying Whiteboards
    * these messages include: selecting a whiteboard, making a new whiteboard, drawing, changing bg, users entering/exiting
  - Whiteboard (ADT)
    * has a unique name
    * holds history of all actions done to it
    * calculates artsy meter
- Client-side GUIs:
  - Artist (login screen):
    * must enter a valid IP to connect to server before anything else
    * then, can select whiteboard from list, or create a new one (this opens a Canvas)
      - to select an existing one, must enter username
      - to create one, must enter username, board name, bg color
  - Canvas
    * initially sends either a create or a select message to server, if it's a create message, we get back a history of all actions and users
    * sends and receives new draw actions and users connects/disconnects to/from server, displays them accordingly

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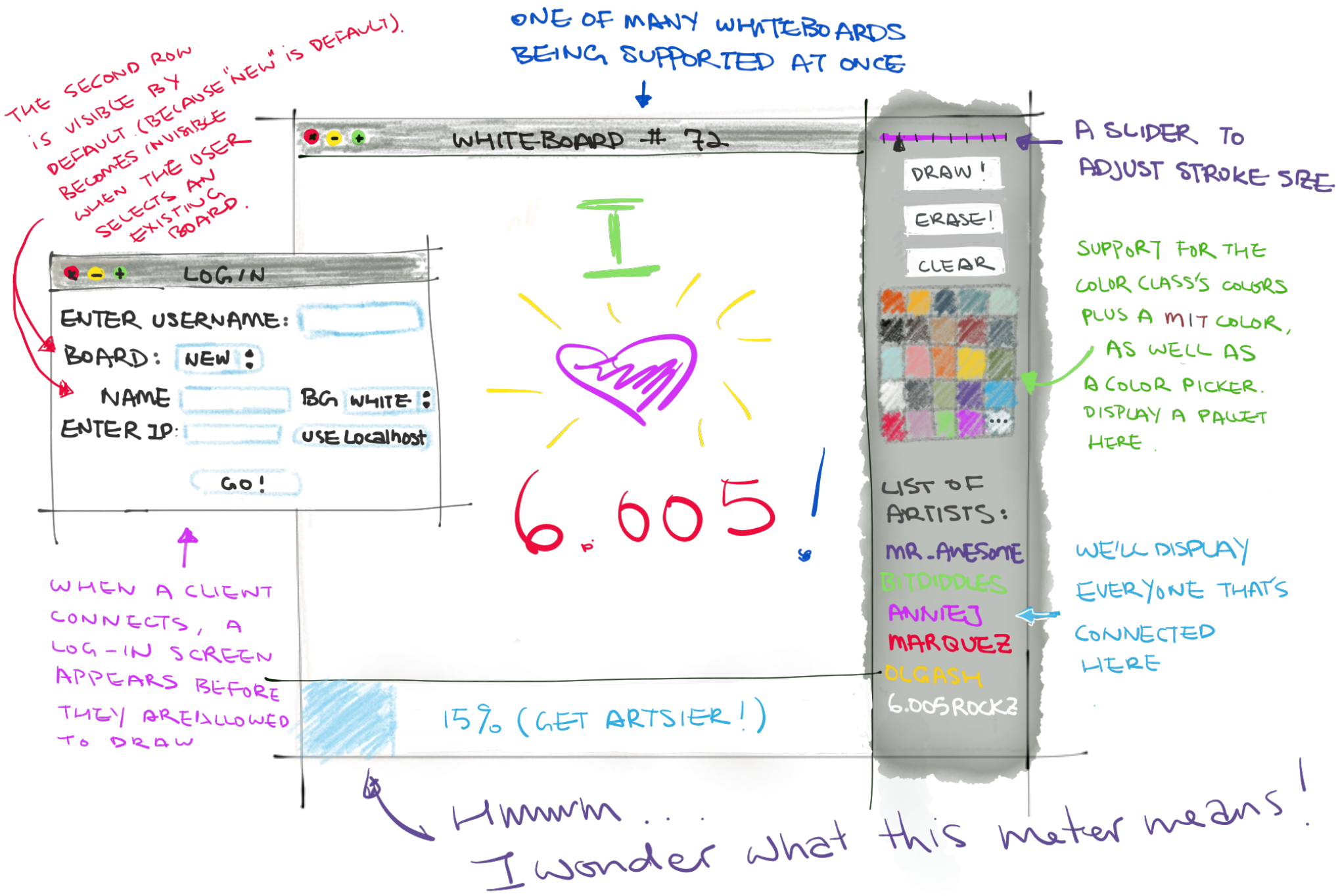
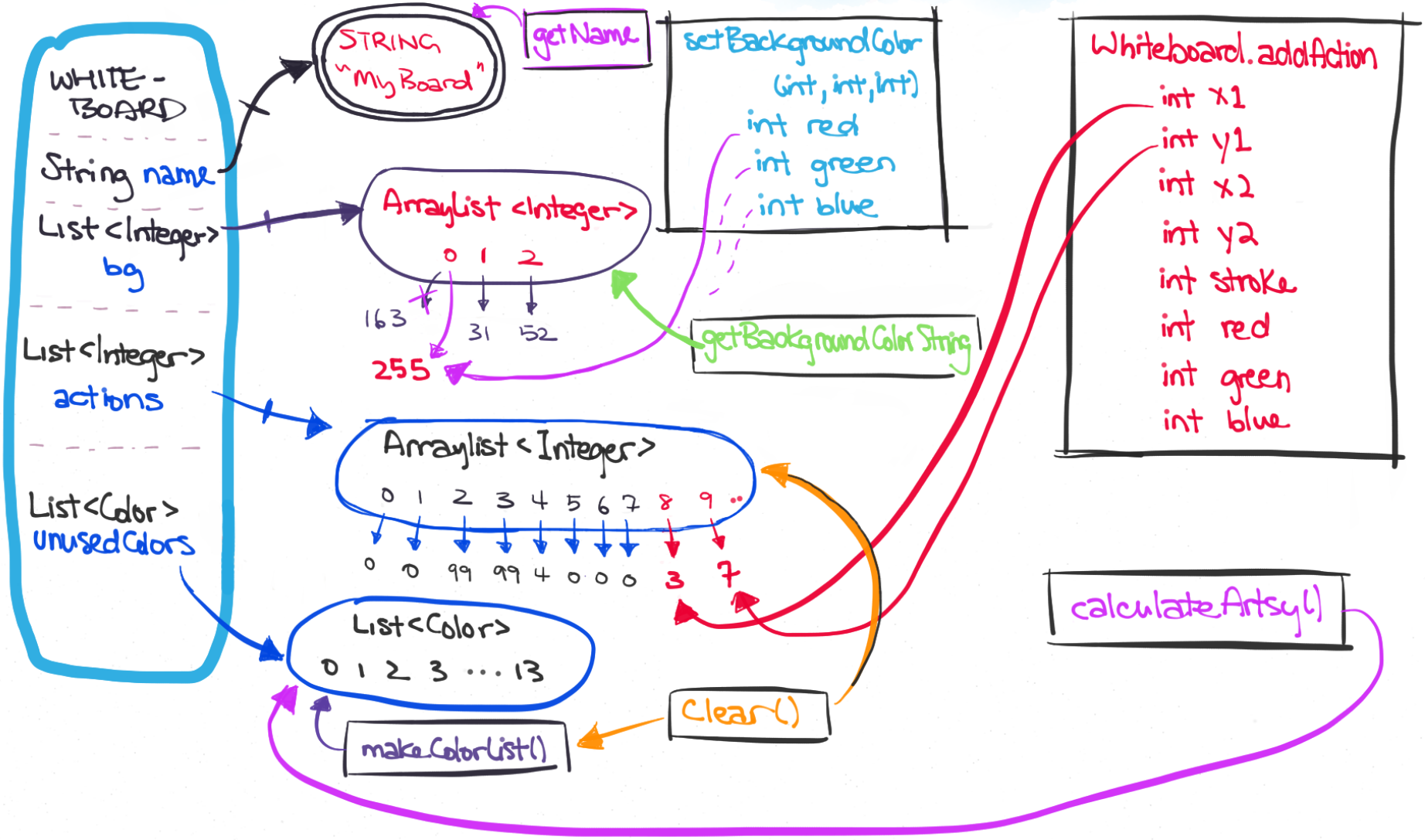
DATATYPE DESIGN [CONTINUED]

* side panel provides tools that allows client-controlled adjustment
    - a pallet that holds all of Color's colors (with custom options)
    - a slider that changes the stroke size
    - a list that shows the usernames of collaborators
    - a button to clear everything from the board
* artsy meter at bottom of screen (whiteboard specific)
* rest of the window is the drawable whiteboard
* on close, notify server of closing


THE SECOND ROW IS VISIBLE BY DEFAULT (BECAUSE "NEW" IS DEFAULT). BECOMES INVISIBLE WHEN THE USER SELECTS AN EXISTING BOARD.
ONE OF MANY WHITEBOARDS BEING SUPPORTED AT ONCE
WHITEBOARD # 72
LOGIN
ENTER USERNAME:
BOARD: NEW
NAME
BG WHITE
ENTER IP:
USE Localhost
GO!
WHEN A CLIENT CONNECTS, A LOG-IN SCREEN APPEARS BEFORE THEY ARE ALLOWED TO DRAW
6.005!
DRAW!
ERASE!
CLEAR
A SLIDER TO ADJUST STROKE SIZE
SUPPORT FOR THE COLOR CLASS'S COLORS PLUS A MIT COLOR, AS WELL AS A COLOR PICKER. DISPLAY A PALLET HERE
LIST OF ARTISTS:
MR_AWESOME
BITDIDDLES
ANNIEJ
MARQUEZ
OLGASH
6.005ROCK2
WE'LL DISPLAY EVERYONE THAT'S CONNECTED HERE
15% (GET ARTSIER!)
Hmmm... I wonder what this meter means!

ADT SNAPSHOT DIAGRAM



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METHODS

- Client (GUIs)
  - Artist
    * toggleNewWhiteboard(boolean visible) - controls whether new whiteboard inputs are visible. If the user does not want to make a new whiteboard, hide the enter whiteboard name and choose background color options.
    * addListeners() - to split the GUI into methods. This adds listeners to the buttons/text fields/combo boxes
    * containsSpace(String) - returns true if a String contains a space. This is to provide appropriate error popups for when usernames and whiteboardnames contain spaces.
  - Canvas
    * setupButtons() - separate the GUI into shorter methods; compartmentalization
    * addListeners() - similar to Artist;
    * setArtsy(int) - determines artsiness of the whiteboard using a hand-picked set of mysterious and magical criteria
    * addRemoveUsers(String, boolean) - adds/removes a username from the JTable of users currently working on the whiteboard
    * setupWhiteboard() - communications with server; Send the server the message to create/select a whiteboard, if it's a new whiteboard, nothing is returned; if it's an existing one, set the background color and users list and draw the actions.

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METHODS [CONTINUED]

    * parseActions(String, boolean withArtsy) - takes in a string representing actions and draws them. The boolean withArtsy lets the method know if a Artsiness value is expected with the string of actions
    * fillBackground() - this was changed from the staff code of fillWith-White(), because we would like to initialize a whiteboard with client-chosen background color
    * defaultSetup() - creates a welcoming image on the default board
    * handleRequest(String) - this method responds to the server's inputs by parsing the string.
    * paintComponents(Graphics), makeDrawingBuffer(), drawLineSegment(), addDrawingController() - these methods are provided by staff

- Server
  – Whiteboard
    * makeColorList() - a helper method for determining artsiness
    * getName() - returns a string representing whiteboard name
    * addAction(8 ints) - adds two pairs of coordinates, stroke size, and rgb values into the list of actions. Also updates the artsiness calculations
    * getBackgroundColorString() - returns the background color's RGB values in a string
    * setBackgroundColor(int red, int green, int blue) - changes the background color. This is synchronized for concurrency.
    * createStringOfActions() - returns a string representing actions performed on the whiteboard. Each action is represented by "x1 y1 x2 y2 [stroke] R G B".
    * calculateArtsy() - determines the artsiness of the board
    * clear() - clears the actions on the board

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METHODS [CONTINUED]

- WhiteboardServer
  * createWhiteboard(String, int, int, int) - make a new whiteboard and add it to the list of existing whiteboards
  * selectWhiteboard(String, String, int) - chooses a whiteboard for according to the Client based on the board name, their username, and their client ID
  * createListOfActions(String) - chooses a whiteboard and calls their createListOfActions method. For descriptions, see above
  * listWhiteboards() - returns a string of all whiteboard names separated by spaces
  * listUsers() - returns all a string of all usernames separated by spaces
  * changeBackgroundColor(board name, RGB ints) - changes a whiteboard's background colors based on RGB values
  * draw(boardName, x1, y1, x2, y2, stroke, RGB) - returns a string of the draw action
  * clear(boardName) - clears everything from the board
  * putOnAllQueuesBut(int clientID, String boardName, String message) - puts the message on all the queues of clients, except the specified client
  * serve() - runs server, listens for and handles the connections. Has handleInput(Socket, int), handleOutput, and handleRequest as helper methods.

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PROTOCOL

- Server - > Client
  - a list of whiteboard names (WB_NAME WB_NAME...)
  - lines of commands for previous whiteboard state (BGCOLOR_R BCOLOR_G BGCOLOR_B ARTSY_METER "USERS" USER_NAME USER_NAME... "ACTIONS" X1 Y1 X2 Y2 STROKE COLOR_R COLOR_G COLOR_B X1 Y1 X2 Y2 STROKE COLOR_R COLOR_G COLOR_B...)
  - new draw actions to everyone connected to a particular whiteboard ("DRAW" ARTSY_METER X1 Y1 X2 Y2 STROKE COLOR_R COLOR_G COLOR_B)
  - new client joins ("NEWUSER" USER_NAME) to all but new client
  - change background color ("BG" COLOR_R COLOR_G COLOR_B)
  - a client leaves ("BYEUSER" USER_NAME)

- Client- > Server
  - initial connect message to request whiteboard names ("HELLO")
  - select whiteboard (add user to the whiteboard, set user name, return whiteboard state) ("SELECT" WB_NAME USER_NAME)
  - make new whiteboard (with color, name), like selecting, but new ("NEW" WB_NAME COLOR_R COLOR_G COLOR_B USER_NAME)
  - new draw actions ("DRAW" WB_NAME X1 Y1 X2 Y2 STROKE COLOR_R COLOR_G COLOR_B)
  - change whiteboard bg color ("BG" WB_NAME COLOR_R COLOR_G COLOR_B)
  - disconnect message ("BYE" WB_NAME USER_NAME)

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CONCURRENCY & THREAD SAFETY

- No objects are shared between any classes, and no mutable objects shared between instances
- All messages sent are sent as strings
- No sockets shared, only IP addresses
- ID numbers for clients will use AtomicInteger as incrementing counter
- Whiteboards are treated independently and do not share information
- Draw actions and add/remove user actions are synchronized on all levels, so no information can be lost/overriden
- Drawing only happens when a message is received from the server, no local drawing, so all users on a whiteboard see the same thing
- Client and server have blocking queues that processes messages
- Only call UI repaint in Swingutilities.invokeLater()

ERROR HANDLING

- The GUI utilizes JOptionPane.showMessageDialog to provide pop-ups with specific error messages.
- Whiteboard name is taken: “That whiteboard name is taken. Please choose a different one!”;
- Whiteboard name contains spaces/is empty: “Whiteboard name cannot be empty and cannot contain spaces.”
- Chosen username contains spaces/is empty: “Username cannot be empty and cannot contain spaces.”

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TESTING STRATEGY

- ADT tests (test public methods of Whiteboard)
  - make sure on initialization, the whiteboard has an artsy meter of zero, and no actions
  - test the name getter
  - test the background color setter and getter
  - test adding new actions and getting them in string format
  - test clearing all actions
  - test the artsy meter increasing when new colors are in actions, but not when custom or repeated colors are added
  - test that the artsy meter returns to 0 when the board is cleared
- Client/server interactions, concurrency, and UI
  - first make sure we can connect via IP address (and localhost) and receive whiteboard names.
  - make sure we can both create and select existing whiteboard with different names and bg colors.
  - make sure the Canvas UI works as planned (artsy meter increases with more colors, all colors work, erasing works, doge button works, clear works).
  - test multiple users sharing one whiteboard (ensure both see the same thing).
  - test multiple whiteboard support (ensure different whiteboards don't send actions to each other).
  - make sure behavior is as expected when one user draws and another user draws/erases common pixels (in equilibrium, the same image must be on both).
  - check to see that whiteboard state is saved during disconnect/reconnect.

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TESTING STRATEGY [CONTINUED]

- Automated testing for client/server interactions
  - use out.println("...") to test that the socket connection works as expected. Namely, messages that begin with tokes "HELLO", "SELECT", "NEW", "DRAW", "BG", "CLEAR", "BYE", and "BYEARTIST"
  - check to see that "DRAW", "BG", "CLEAR", and "NEWUSER" messages get passed to all clients
  - check to see that "BYE" functions as expected
  - use nextNonEmptyLine(in) and asserts to check that the response is as expected. For example, "HELLO" should give back the list of whiteboards to the client