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 white-board, 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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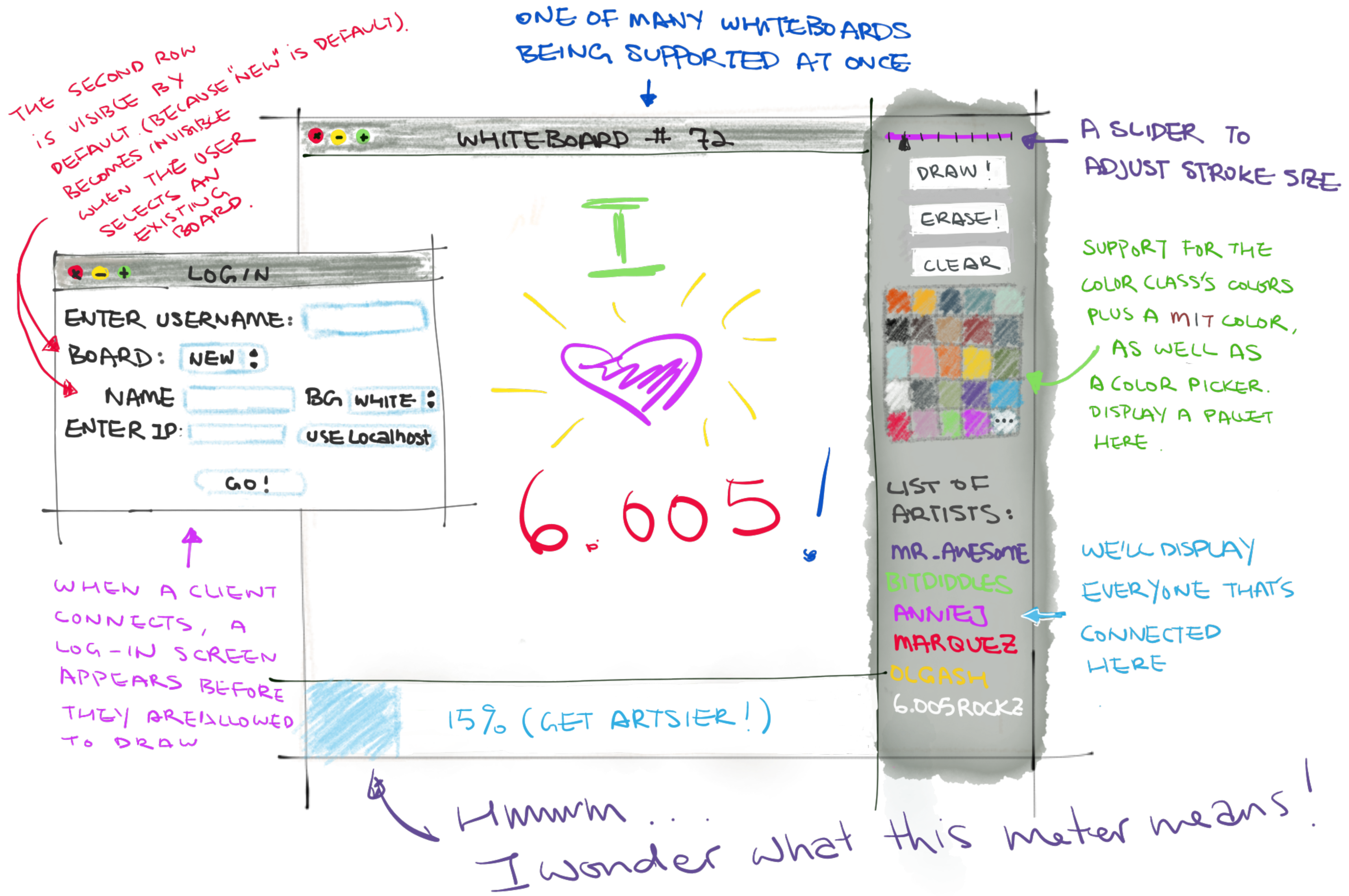
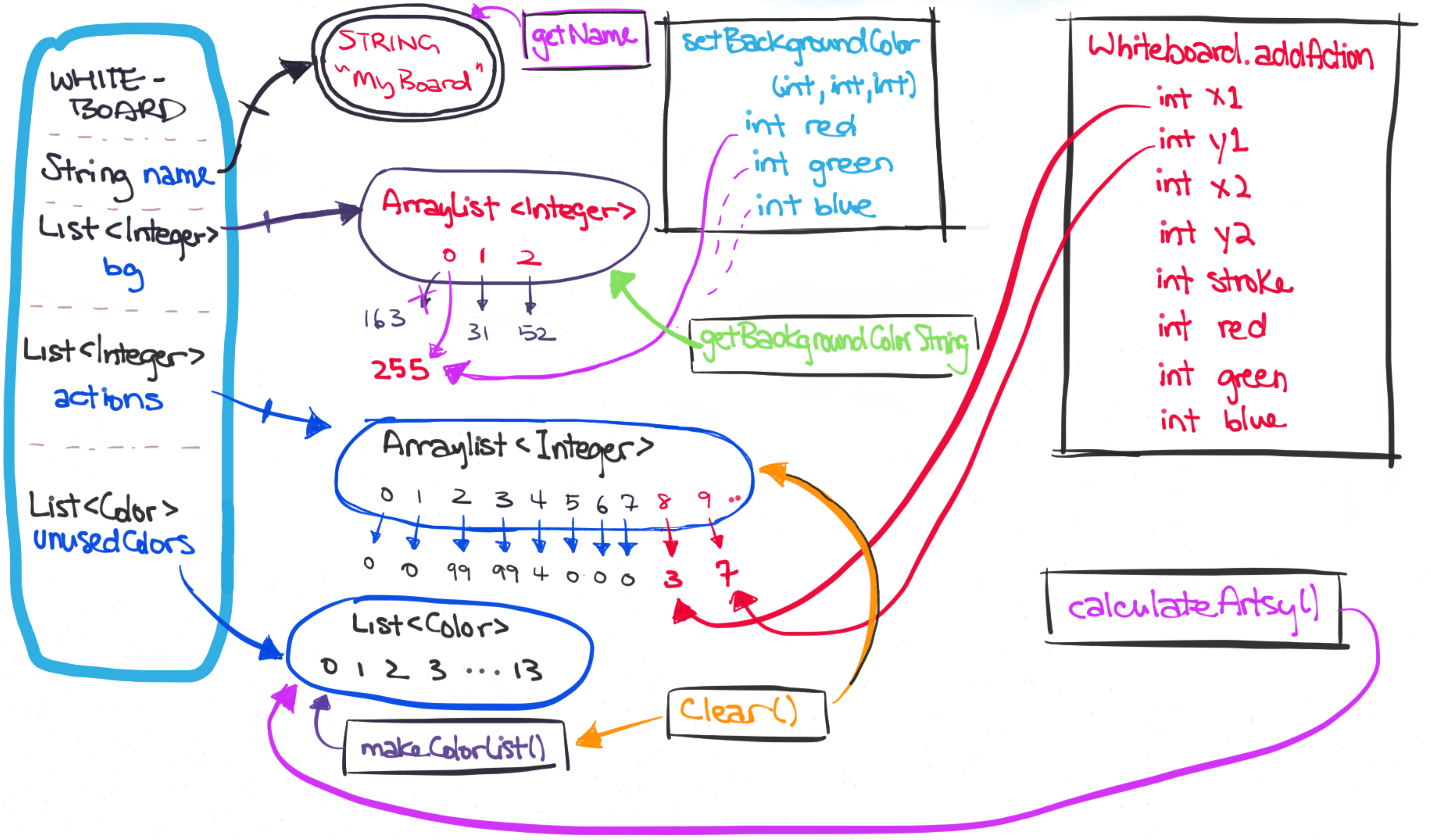
DATATYPE DESIGN [CONTINUED]

* 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


ONE OF MANY WHITEBOARDS BEING SUPPORTED AT ONCE
WHITEBOARD # 72
THE SECOND ROW IS VISIBLE BY DEFAULT (BECAUSE "NEW" IS DEFAULT). BECOMES INVISIBLE WHEN THE USER SELECTS AN EXISTING BOARD.
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!
A SLIDER TO ADJUST STROKE SIZE
DRAW!
ERASE!
CLEAR
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
6.005ROCKZ
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 handpicked 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 back-ground color. This is synchronized for concurrency.
        * createStringOfActions() - returns a string representing actions per-formed 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.