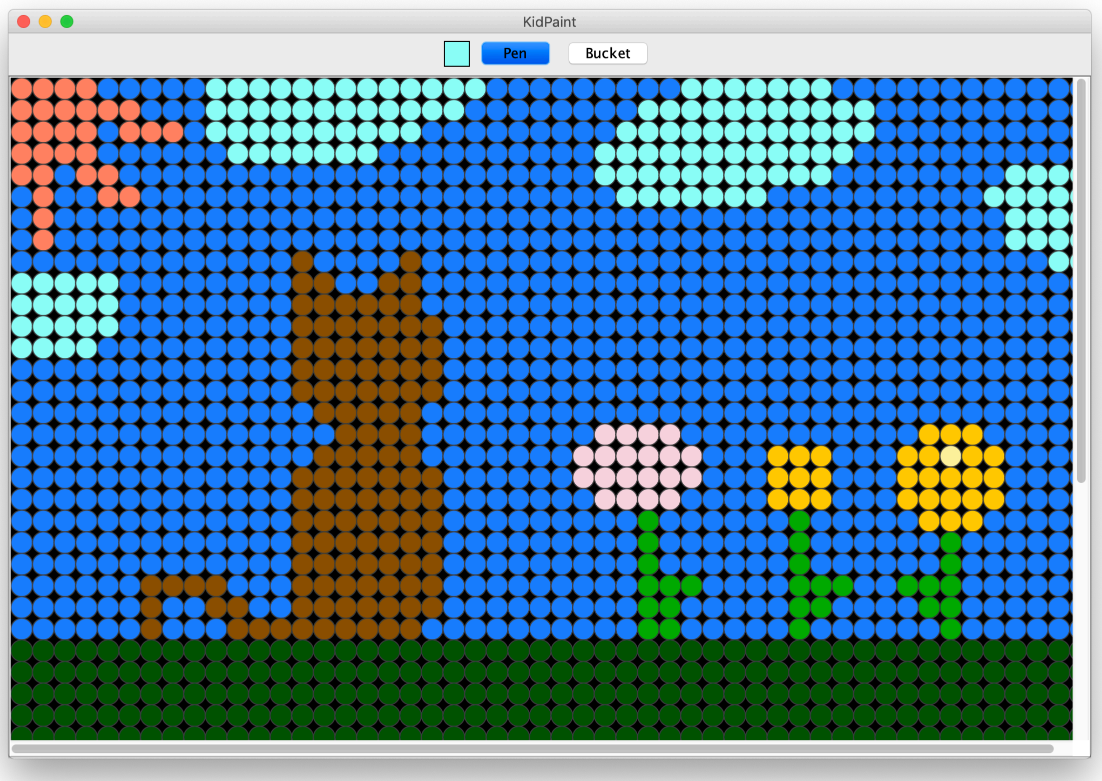
COMP3015 Data Communications and Networking

Project 2019-20

Introduction

KidPaint is a paint app for kids. A kid can use a pen or bucket with different colors to draw and paint something on the sketchpad. The following is the layout of ***KidPaint***:



Problems

The vender now wants to add some network features to ***KidPaint***, so that multiple kids are able to draw on the same sketch at the same time through network connections. And, they can also communicate with each other. A message user interface with a key input event handler is ready in ***KidPaint*** but any network-related kinds of stuff are not yet implemented.

Required Techniques

To complete the task, you are required to have the programming knowledge including basic Java UI, streaming, socket programming (TCP + UDP), multithreading, and basic OOP concepts.

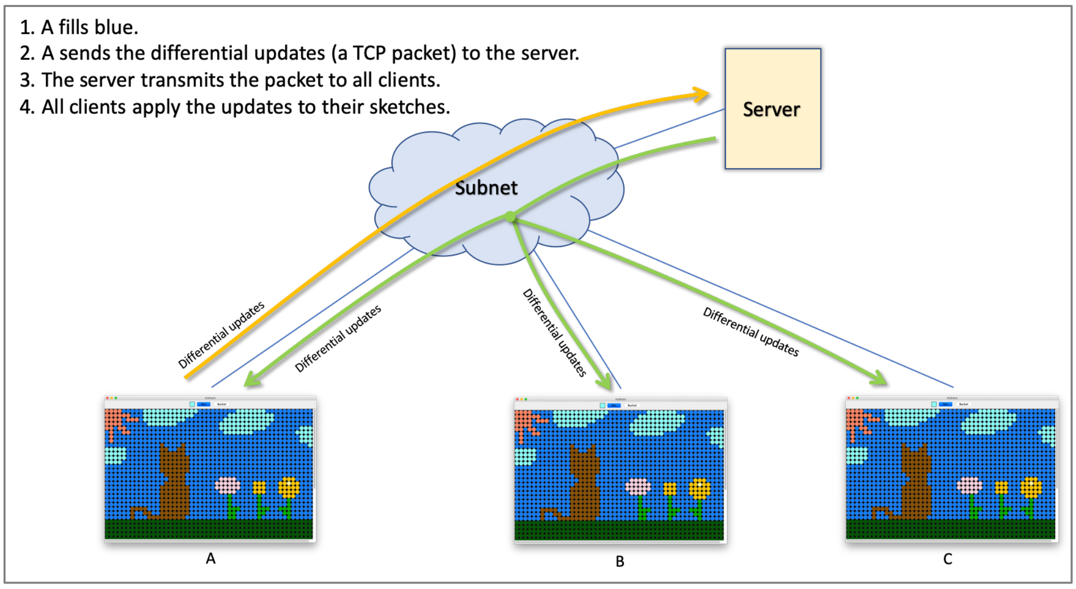
Tasks

You have to perform the followings:

1. Form a 2-member group.
2. Download the Java code of ***KidPaint*** from our course web page.
3. Add the network features to ***KidPaint*** for fulfilling **one** of the following approaches:
    a. Basic client-server approach (max. 60 marks)
    b. Advanced client-server approach (max. 70 marks)
    c. Peer-to-peer approach (max. 80 marks)
4. Add additional features to ***KidPaint***. (max. 20 marks)
5. Read the detailed requirements of each approach and explorer the codes of ***KidPaint*** before starting the design and implementation.

Basic client-server approach (max. 60 marks)

Your version of ***KidPaint*** should fulfill the following requirements:


1. A fills blue.
2. A sends the differential updates (a TCP packet) to the server.
3. The server transmits the packet to all clients.
4. All clients apply the updates to their sketches.
Server
Subnet
Differential updates
Differential updates
Differential updates
Differential updates
A
B
C

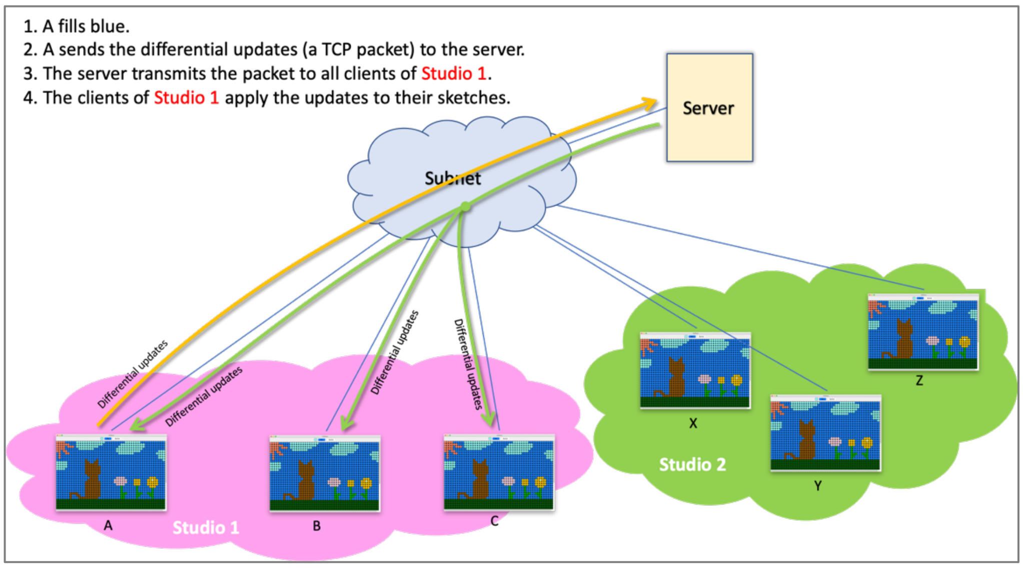
1. A server runs in the same subnet. The server-side program does not require any GUI.
2. The original ***KidPaint*** program must be run as a client-side program.
3. When ***KidPaint*** (client) has just been launched, it shows a GUI for inputting the user name. After inputting the name, the client broadcasts a request to the network using UDP.
4. When the server received the request, it sends a UDP packet with its IP address and port number back to the client.
5. Once the client receives a reply from the server, the client establishes a TCP connection to the server and downloads the sketch data. The sketch will then be rendered in the sketchpad of the client.
6. The kid does not need to input anything related to the network setting including the IP address and port number of the server.

7. The client sends TCP packets with differential updates to the server if the kid drew on the sketchpad.
8. The client will receive TCP packets with differential updates from the server if other kids (other clients) drew on the sketchpads. Then, the client applies the updates to its sketch.
9. The client sends a TCP package with a message to the server if the kid typed a message in the message field and pressed ENTER.
10. The client will receive a TCP packet with a message from the server if one of the kids typed a message in the message field and pressed ENTER.
11. The received message with the sender's name will be displayed in the chat area immediately.
12. A new button should be added to the client-side program for saving the sketch data into a local file.
13. A new button should be added to the client-side program for loading the sketch data from a local file. The sketch data must be sent to the server, and the sketchpads of all connected clients must be updated then.
14. With this approach, all kids draw on the **SAME** sketch.

Advanced client-server approach (max. 70 marks)

Your version of ***KidPaint*** should fulfill the requirement point 1 to point 13 of the basic client-server approach and support multiple sketches. The followings are the additional requirements:

1. The server sends a list of studios to the client once a TCP connection established.
2. On the client, a GUI shows a list of studios.
3. The kid can either select one of the existing studios .or create a new studio.
4. If the kid selects one of the existing studios, the client then downloads the sketch data of the selected studio and show the sketch in the sketchpad.
5. If the kid creates a new studio, a GUI should show and let the kid decide the size of the sketch (width and height) for the new studio.
6. The sketch data and messages will be sent to the clients who are in the SAME studio only.

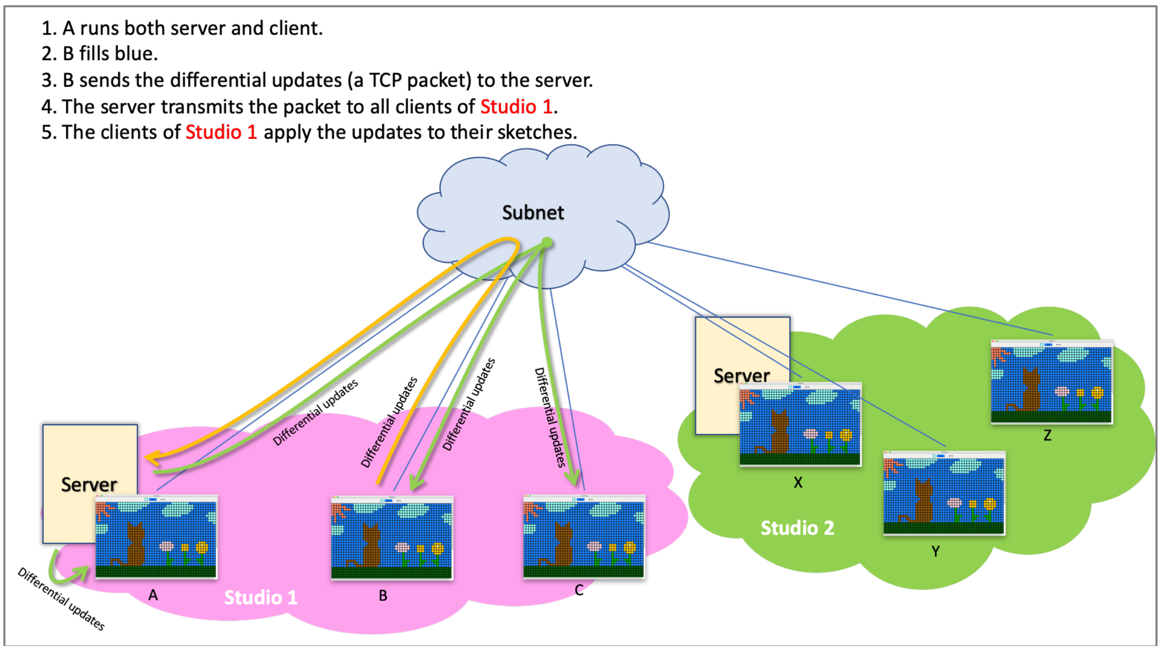


1. A fills blue.
2. A sends the differential updates (a TCP packet) to the server.
3. The server transmits the packet to all clients of Studio 1.
4. The clients of Studio 1 apply the updates to their sketches.

Peer-to-peer approach (max. 80 marks)

Your version of ***KidPaint*** should fulfill the requirement point 5 to 14 from the basic client-server approach and the following additional requirements:

1. Combine the server-side code and client-side code into ***KidPaint***. So, ***KidPaint*** can either run as a client or a server plus a client. If it runs as server plus client, the server-side code handles the data transmission among clients.
2. When ***KidPaint*** has just been launched, it prompts for inputting the user name. Then, it broadcasts a request to the network using UDP.
3. When a server received the request, it sends a reply with its studio name, IP address and port number back.
4. When ***KidPaint*** received the replies (from multiple servers), it shows a list of studio names and allows the kid to select one of the studios or create a new studio.
5. If the kid selected one of the studios, ***KidPaint*** then runs as a client.
6. If the kid created a new studio, ***KidPaint*** then runs as a server plus client.
7. The sketch data (including differential updates and data loaded from the local file) and messages will be sent to the clients who are in the SAME studio only.


1. A runs both server and client.
2. B fills blue.
3. B sends the differential updates (a TCP packet) to the server.
4. The server transmits the packet to all clients of Studio 1.
5. The clients of Studio 1 apply the updates to their sketches.
Subnet
Server
Differential updates
Differential updates
Differential updates
Differential updates
Differential updates
A
Studio 1
B
C
Server
X
Studio 2
Y
Z

Additional Features (max. 20 marks)

You need to add additional features to ***KidPaint***. The marks are dependent on the difficulty level, functionalities, and completions of the additional features.

Project Schedule

21 November 2019
Submit your **Source Codes** through BUMoodle no later than **11:00 PM, 21 November 2019**

22 November 2019
Demonstrate your project

- Project demonstration is mandatory. It includes
  - Execute the source codes submitted by you;
  - Demonstrate the major functions;
  - Q&A.

- If you don't attend the demonstration session, or you cannot explain your own source codes correctly during Q&A, you may get zero marks even if your program runs successfully.