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1. Problem solving:

The flow of this project is as follows:

Basic info:

1.

udpclient:

ask user to enter the username

ask user to enter the password

udpserver*:*

verify the username and password, if not, send feedback to udpclient

details:

Udpclient*: send information in the form: group name + "$" + "option"--->Udpsender*

Udpserver*: split the info received from udpclient: group name, request(according to the special character '$')*

Check if the group name received from udpclient matches the group name created before:

If matches, get the request join and the array has space to join the array:

Then add the udpclient to the array of client which is of maximum size: send "Positive match" message to udpclient

Else(exception handling):

if group name does not match: send "Negative match" message to udpclient

2.

udpclient:

ask user to enter the filename

udpserver*:*

check if the file is valid, if not, send feedback to udpclient

details:

udpsender*:*

fopen() to open the file, it will return a file descriptor fp, if fp == null, then file not valid, send feeback to udpclient

2. Data Structure:

2.1 The data for this project mainly include username, password and value, two data structure can be used here(I derived it from project 1):

1) *Username, password and value can be grouped by array, i.e.*

```
char* gusername[NUMBER];
char* gpassword[NUMBER];
```

2) *Use struct:*

```
Struct company {
        Char * username;
        Char * password;
}
```

For this project, I choose the 1st way to store my data:

I read "./user.txt" file using file I/O:

```
FILE* fp = fopen("user.txt","r");
```

And Read every item:

```
for(int i = 0; i < 6;i++){
        gusername[i]=(char*)malloc(256*sizeof(char));
        gpassword[i]=(char*)malloc(256*sizeof(char));
}
for(int i = 0; i < 6; i++){
    for(int j = 0; j < 2; j++){
        fscanf(fp, "%s", buffer);
        if(j%2 == 0){
            strcpy(gusername[i],buffer);
        }
        else if(j%2 == 1){
            strcpy(gpassword[i], buffer);
        }
    }
}
```

2.2 I also define a struct to store the info of frames, it includes 4 fields :

```
struct frame{
    int kind;//transmission(0) or retransmission(1)
    int seq;
    int ack;
    char info[FRAMESIZE];
};
```

The kind field tells us whether this frame is transmission frame ot retransmission frame,
The seq and ack fields are used for sequence numbers and acknowledgements, respectively;
The info field of a data frame contains a single packet
It is defined both in udpsender, as well as udpclient

2.3 I create a list to store each frame called frameList in udpclient, it is defined below:

```
struct frame frameList[windowSize];
//it is an array and it stores a list of struct frame.
```

So everytime I receive a frame from sender, I will put the frame into frameList.(details in 2.4)

And I also create a list to record if the frame was received before called ackList, it is defined below:

```
int ackList[windowSize];
```

So everytime I receive a frame from sender, I will set the corresponding elment in ackList to 1.(details in 2.4)

2.4 When I receive an frame, I will chech its' sequence number if it falls within the window. If it is, then it's accepted and stored. Here I just use an if condition to check this:

```
if(recvFrame.seq >= 0 && recvFrame.seq < windowSize && ackList[recvFrame.seq] != 0){
    //store the frame in frameList
    frameList[recvFrame.seq] = recvFrame;
```

```
        ackList[recvFrame.seq] = 1;
    }
    else{
        printf("Sequence number does not fall within the window\n");
    }
```

3. User define function:

I defined multiple functions in udpserver.c and udpclient.c file:

1) *The declaration of these functions in udpserve.c are as follows:*

```
int Authenticate(char username[], char password[]){
  int index = -1;//-1 means no matching username;
  for(int i = 0; i < 6; i++){
        if(strcmp(gusername[i],username) == 0 && strcmp(gpassword[i], password) == 0){
            return 0;
        }
  }
  return -1;
};
```

This function is used to check the pair, username and password, if they are right, then return 0, Or else return -1

2) *Time out*

Every time I send a frame, I will create a new thread for timing, the thread function is defined as below:

```
void* timer(void* arg){
        struct argsThread args;
        args = *(struct argsThread*)arg;
        int seq = args.seq;
        sleep(0.00001);
        if(args.ackList[seq] == 1){
            printf("Time out\n");
        }
};
```

4. Screen shots of outputs:

Client:

```
zhengguan@ubuntu:~/Data Networks/Project4$ ./client.o 192.168.11.136 55397 user.txt a.txt
Socket created.
Bind completed!
Welcome to project 4 :)
Please enter username:
apple
Please enter password:
1
username and password sent: apple$1
Positive match
Username and password verified

Start to transfer the file or not(Y/N):Y
Filename sent: a.txt
Input file name verified, ready to receive data...
Create output file done

Window size received: 1
Total frame number received: 13

Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission
```

```
Ready to write to file...
Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission

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Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission

Ready to write to file...
Sequence number: 0
Type: transmission

Ready to write to file...
File transfer done
zhengguan@ubuntu:~/Data Networks/Project4$ S
```
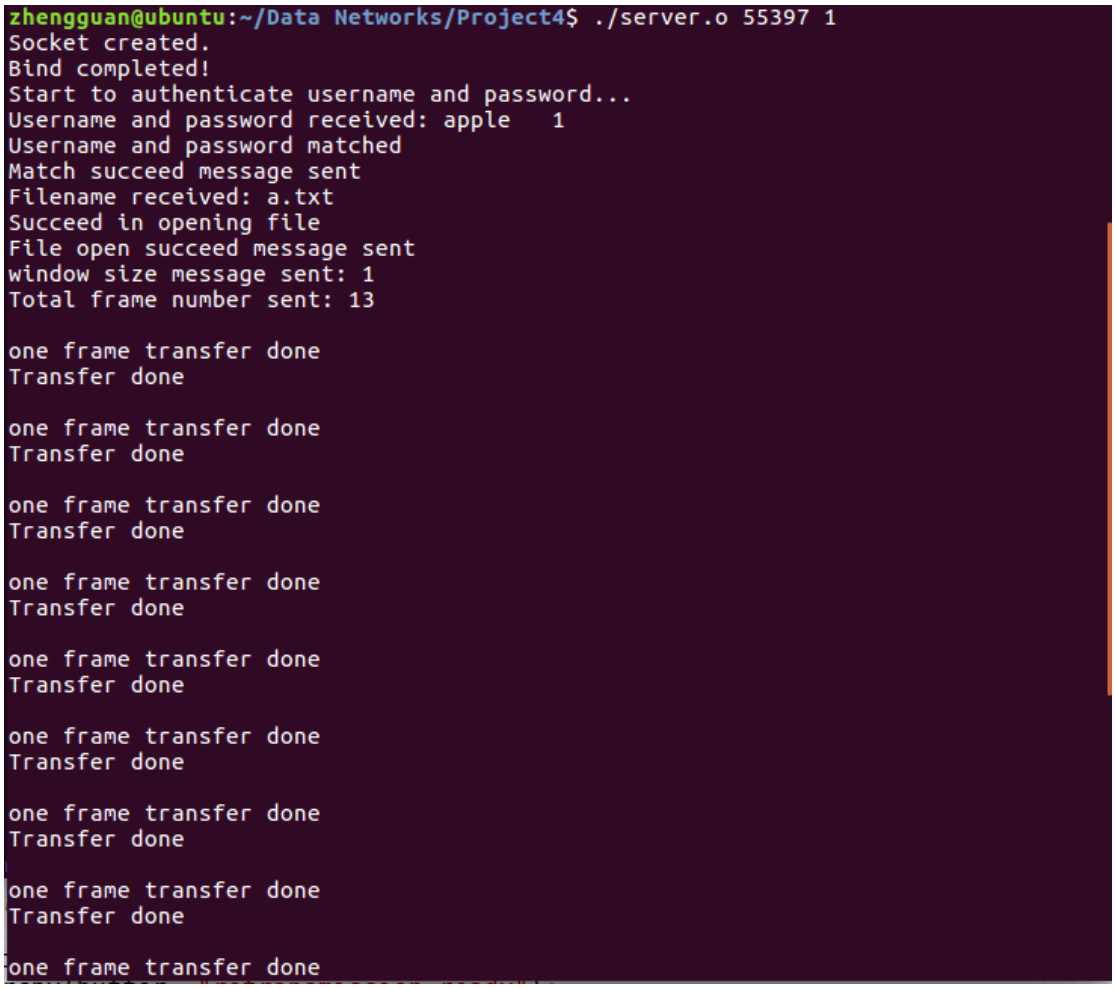
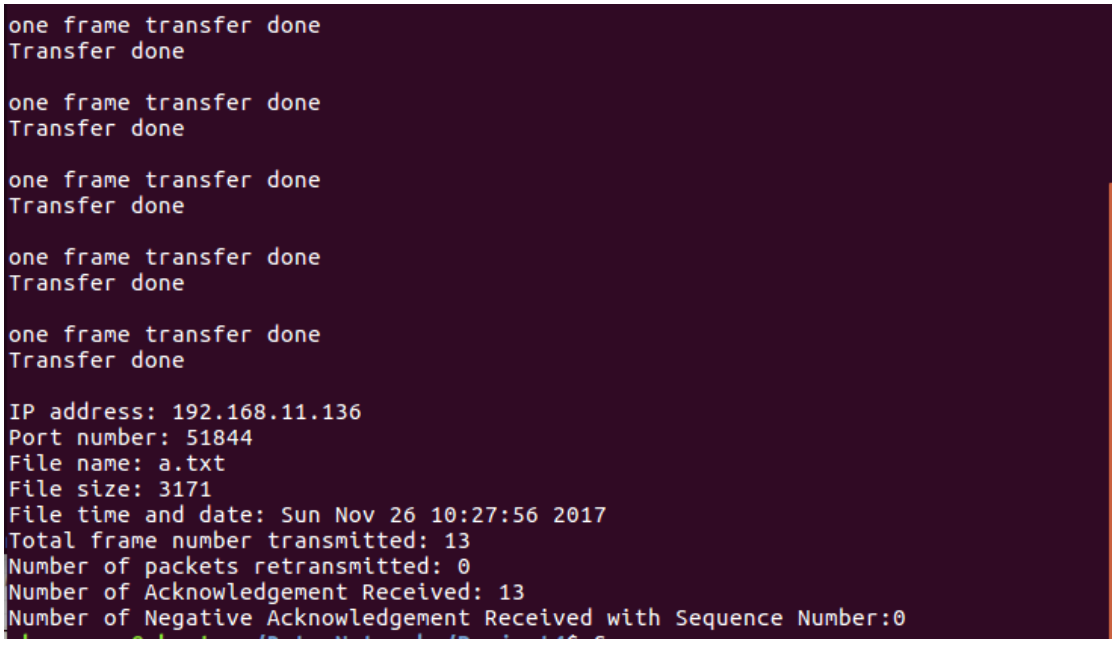

Server:





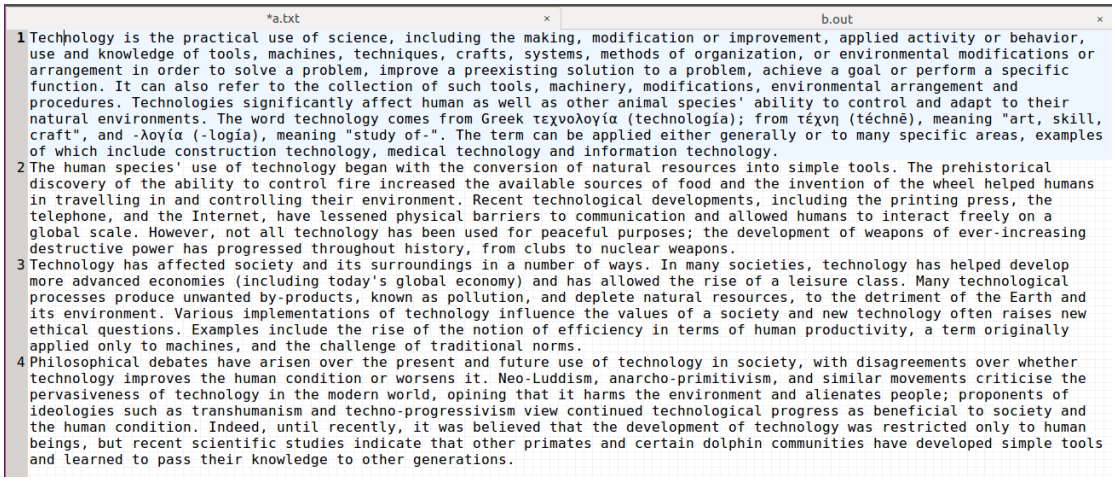
Admission ☹:

I have to admit, my program still has some flaws, I copy the buffer into the frame info, but the content of

them are not exactly the same, I don't know why. Need to fix later. Thanks.

File compare:

Original:



My hurtbreaking result: