Luis Ruiz

CPE 400-1001

5001441817

Socket Programming Project

Server Program – Programed in C

- The server allows for multiple clients to connect to it. Note it will terminate once all clients have disconnected from it. However, there is a segment of code that will allow it to hang and wait for a connection if it is commented out; this snip will be highlighted below.
- Requires two arguments
    - ./executable portno

```
//CPE-400
//SECTION: 1001
//Luis Ruiz
//server code

#include <string.h>
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/time.h>  //FD_SET,FD_CLR,FD_ZERO
#include <sys/socket.h>
#include <netinet/in.h>
#include <ctype.h>

#define MAX_CLIENT 30
#define TRUE 1
#define FALSE 0

///FUNCTIONS
void error(char* msg);
void palindrome(char* msg, int clientfd);

//MAIN
//------------------------------------------------------------------------
//------------------------------------------------------------------------
int main(int argc, char* argv[])
{

        int sockfd, portno;
```

```
int clientfd[MAX_CLIENT] = {0};
unsigned int clilen;
int new_clientfd;
fd_set readfds;

unsigned int count = 0;
int max_sd,sd,activity,valread;
unsigned int i;

char* buffer = (char*) calloc(500,sizeof(char));
struct sockaddr_in serv_addr,  cli_addr;

if (argc < 2)
{
        fprintf(stderr, "\n%s\n", "ERROR: Please type in the following format");
        fprintf(stderr, "%s\n", "./executable portno.");
        error("\n");
}

//convert the port number to an integer
portno = atoi(argv[1]);

//start a new socket
sockfd = socket(AF_INET,SOCK_STREAM,0);
if(sockfd < 0)
        error("ERROR opening socket\n");

//zero out my address buffer
bzero((char *) &serv_addr, sizeof(serv_addr) );

serv_addr.sin_family = AF_INET;
serv_addr.sin_port = htons(portno);                             //port number
serv_addr.sin_addr.s_addr = INADDR_ANY;

//To assign a local socket address.
if (bind(sockfd, (struct sockaddr *) &serv_addr, sizeof(serv_addr)) < 0)
        error("ERROR on binding\n");

if(listen(sockfd,MAX_CLIENT) < 0)
        error("Error listening to socket\n");

//get the lenght of the client address
clilen = sizeof(cli_addr);
puts("Waiting for connections ...");
```

```
//Loop that will test the clients sent string
while(TRUE)
{
	//clear the socket set
	FD_ZERO(&readfds);

	bzero(buffer,500);

	//add severs socket descriptor to set
	FD_SET(sockfd, &readfds);
	max_sd = sockfd;

	//add child sockets to set
	for ( i = 0 ; i < MAX_CLIENT ; i++)
	{
		//socket descriptor
		sd = clientfd[i];

		//if valid socket descriptor then add to read list
		if(sd > 0)
			FD_SET(sd,&readfds);

		//highest file descriptor number, need it for the select function
		if(sd > max_sd)
			max_sd = sd;
	}

	//checks for which client is active
	activity = select(max_sd+1, &readfds , NULL , NULL , NULL);

	//If something happened on the master socket ,
	//then its an incoming connection
	if (FD_ISSET(sockfd, &readfds))
	{
		new_clientfd = accept(sockfd, (struct sockaddr *) &cli_addr, &clilen);
		if(new_clientfd < 0)
		{
			error("ERROR on accept\n");
		}

		//add new socket to array of sockets
		for (i = 0; i < MAX_CLIENT; i++)
		{
			//if position is empty
			if( clientfd[i] == 0 )
			{
```

```
                                ++count;
                                clientfd[i] = new_clientfd;
                                printf("Adding to list of sockets as %d\n" ,i);

                                break;
                        }
                }
        }

        //else operate on some other socket
        for (i = 0; i < MAX_CLIENT; i++)
        {
                //reset my buffer
                bzero(buffer,500);

                //grab the socket descriptor
                sd = clientfd[i];

                //check if that descriptor is in my montior
                if(FD_ISSET(sd ,&readfds))
                {
                        if(read(clientfd[i],buffer,500) < 0)
                                error("ERROR reading from socket\n");

                        //The user simply pushed enter or ctrl+c to exit the connnection
                        //on the other end
                        if(strlen(buffer) <= 1)
                        {
                                fprintf(stderr, "Closing connection too Client %d\n", sd);
                                close(sd);
                                clientfd[i] = 0;
                                --count;
                                break;
                        }
                        //the socket has sent a valid string
                        else
                        {
                                fprintf(stderr, "\nHere is a message from Client %d:
%s\n",sd,buffer);

                                palindrome(buffer,sd);
                        }
                }
        }

        //If we wish to have the server never close it's connections
        //then can simply comment out this portion of the code
```

```
                //this will allow it to hang and wait for any connections
                if(count == 0)
                {
                        FD_ZERO(&readfds);
                        printf("\n%s\n", "No More Connection are available!!!");
                        break;
                }

        }

exit:

        for(i = 0; i < MAX_CLIENT ;i++)
                if(clientfd[i]!=0)
                        close(clientfd[i]);

        return 0;
}
//-------------------------------------------------------------------------
//-------------------------------------------------------------------------
//FUNCTION BODIES

void error (char* msg)
{
        fprintf(stderr, "%s\n", msg);
        exit(1);
}

void palindrome(char* msg,int clientfd)
{
        //temp will just hold a copy of the msg passed in
        //token will be used to tokenize the string
        //str will be the concatentation of the token strings
        char* temp = (char*)calloc(500,sizeof(char));
        char* token;
        char* str = calloc(500,sizeof(char));
        strcpy(temp,msg);

        //loop that is used to concatenate
        token = strtok(temp," \n");
        while(token!=NULL)
        {
                strcat(str,token);
                token = strtok(NULL," \n");
        }
```

```
        //remove the linefeed
        msg = strtok(msg, "\n");

        //messages
        char* isPalindrome = (char*)calloc(500,sizeof(char));
        char* notP = ": is Not a Palindrome!!\n";
        char* isP = ": is a Palindrome!!\n";

    // Start from leftmost and rightmost corners of str
    int l = 0;
    int h = strlen(str)-1;

    // Keep comparing characters while they are same
    while (h > l)
    {
        if(isalpha(str[l]) > 0)
                tolower(str[l]);

        if(isalpha(str[h]) > 0)
                tolower(str[h]);

       if (str[l++] != str[h--])
       {
          //send the message to our client
          strcpy(isPalindrome,msg);
          strcat(isPalindrome,notP);
          if(write(clientfd,isPalindrome,500) < 0)
                        error("ERROR:writing to client file descriptor\n");
          return;
       }
    }

    //send the message to our client
    strcpy(isPalindrome,msg);
    strcat(isPalindrome,isP);
    if(write(clientfd,isPalindrome,500) < 0)
                error("ERROR:writing to client file descriptor\n");
}
```

Client Program – Programed in C

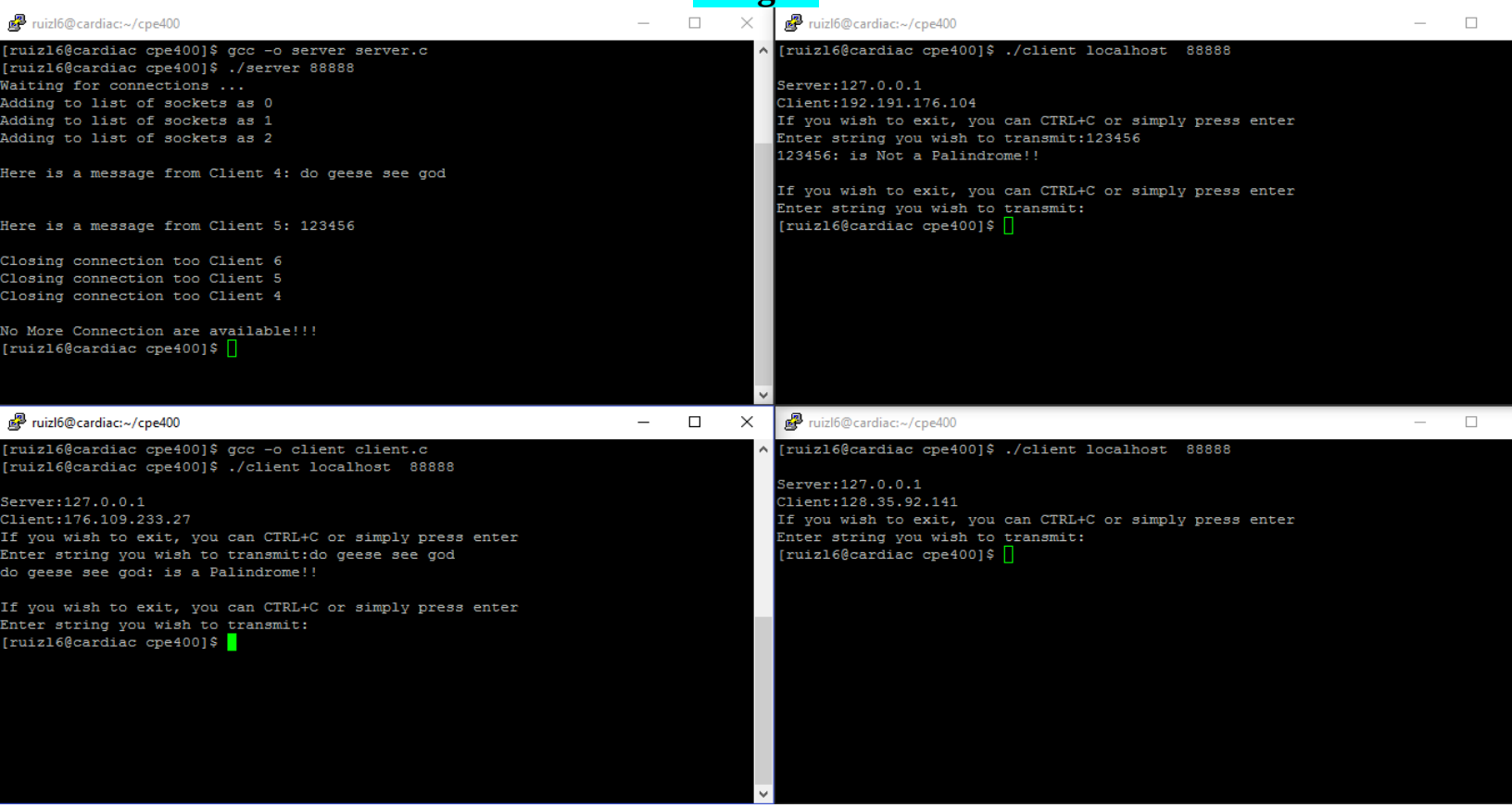
- Simple client code that send a string to a server and receives an answer, when you compile the program it requires 3 arguments:
    - ./executable X portno.
    - X is the machine name and if on the same machine put *localhost*

```
//CPE-400
//SECTION: 1001
//Luis Ruiz
//Client code

#include <string.h>
#include <stdlib.h>
#include <stdio.h>
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <netdb.h>


#define TRUE 1
#define FALSE 0

//display error messages
void error(char *msg)
{
	perror(msg);
	exit(0);
}

void getIp(struct sockaddr_in serv_addr,struct sockaddr_in cli_addr)
{
	//get the server ip and convert it to a readable string
	struct sockaddr_in* IPV4_client = (struct sockaddr_in*)&cli_addr;

	//string that will hold the servers ip
	char client[INET_ADDRSTRLEN];
	inet_ntop( AF_INET, &IPV4_client, client, INET_ADDRSTRLEN );

	//get the client ip and convert it to a readable string
	struct sockaddr_in* IPV4_server = (struct sockaddr_in*)&serv_addr;
	struct in_addr server_addr = IPV4_server->sin_addr;

	//string that will hold the clients ip
	char server_ip[INET_ADDRSTRLEN];
	inet_ntop( AF_INET, &server_addr, server_ip, INET_ADDRSTRLEN );

	//print to stdout the two ips
	fprintf(stderr,"\nServer:%s\nClient:%s\n",server_ip,client);
}

int main (int argc, char *argv[])
```

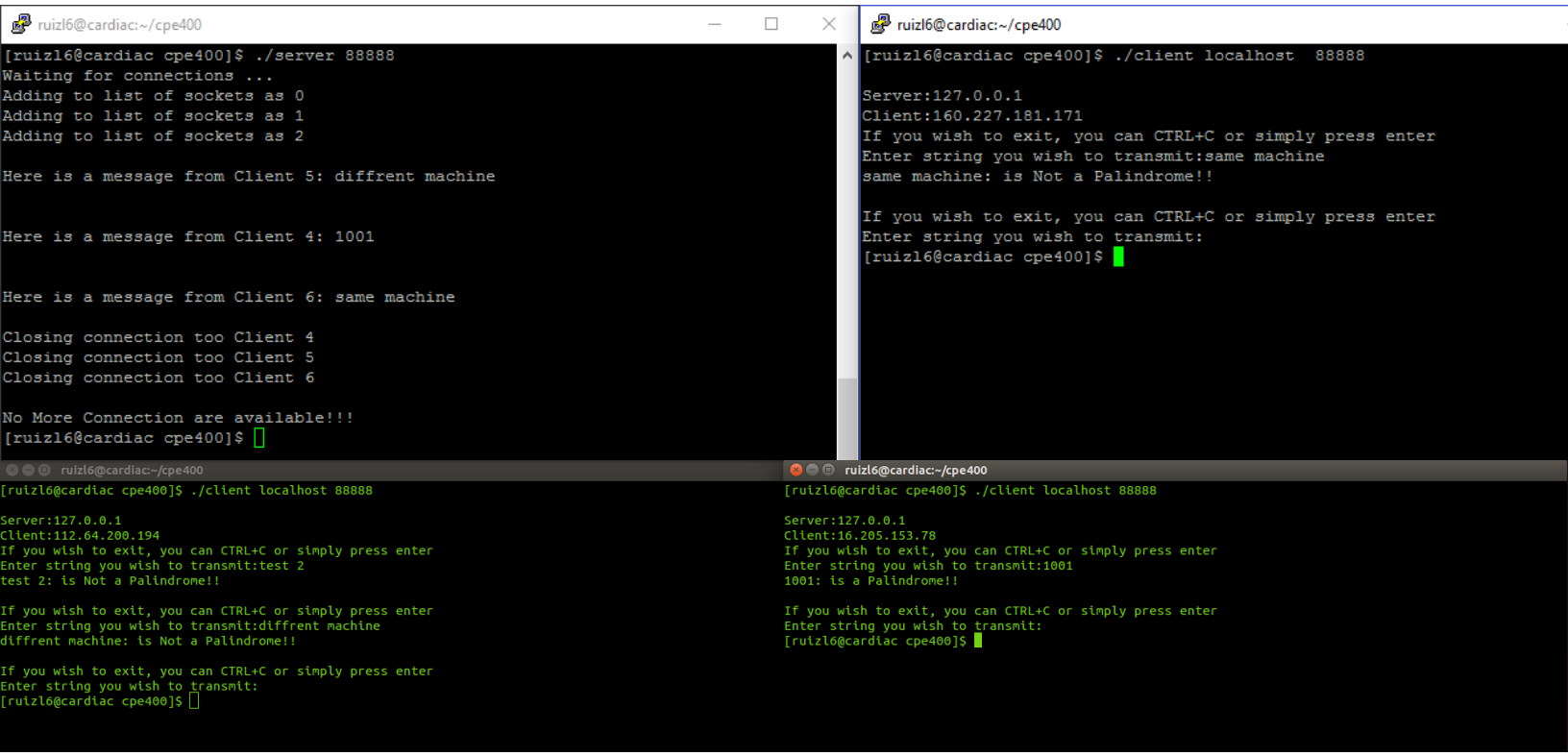
```
{
	int sockfd,  portno, n;
	struct sockaddr_in serv_addr, cli_addr;
	struct hostent *server;
	char buffer[500];

	//check if hostname of server and port number is provided
	if (argc < 3)
	{
		fprintf(stderr, "%s\n", "ERROR:");
		fprintf(stderr,"usage %s hostname port\n", argv[0]);
		exit(0);
	}

	//get desired port connection
	portno = atoi(argv[2]);

	//creating our socket
	sockfd = socket(AF_INET, SOCK_STREAM, 0);
	if (sockfd < 0)
		error("ERROR opening socket");

	//get the host name
	server = gethostbyname(argv[1]);
	if (server == NULL)
	{
		fprintf(stderr,"ERROR, no such host\n");
		exit(0);
	}

	//zero out the address first
	bzero((char *) &serv_addr, sizeof(serv_addr));

	//assign values to serv_addr variable
	serv_addr.sin_family = AF_INET;		//for IPv4 communication
		//copy h_addr to s_addr
	bcopy((char *)server->h_addr,(char *) &serv_addr.sin_addr.s_addr,server->h_length);

	//port number
	serv_addr.sin_port = htons(portno);

	getIp(serv_addr,cli_addr);

	//requesting connection to server
	if (connect(sockfd,(struct sockaddr *) &serv_addr, sizeof(serv_addr)) < 0)
		error("ERROR connecting");
```

```
while(TRUE)
{
	bzero(buffer,500);

	fprintf(stderr, "%s\n", "If you wish to exit, you can CTRL+C or simply press enter");
	fprintf(stderr, "%s","Enter string you wish to transmit:" );

	//get string
	fgets(buffer,500,stdin);

	//if the buffer is empty end the client communication
	if(strlen(buffer) == 1 )
		return 0;

	//sending message to host server
	send(sockfd,buffer,sizeof(buffer),0);

	bzero(buffer,500);

	//recieving message from host server
	recv(sockfd,buffer,sizeof(buffer),0);
	printf("%s\n",buffer);

	bzero(buffer,500);
}

	//close file descriptor
	if(close(sockfd) < 0)
		error("ERROR: on closing");

	return 0;
}
```

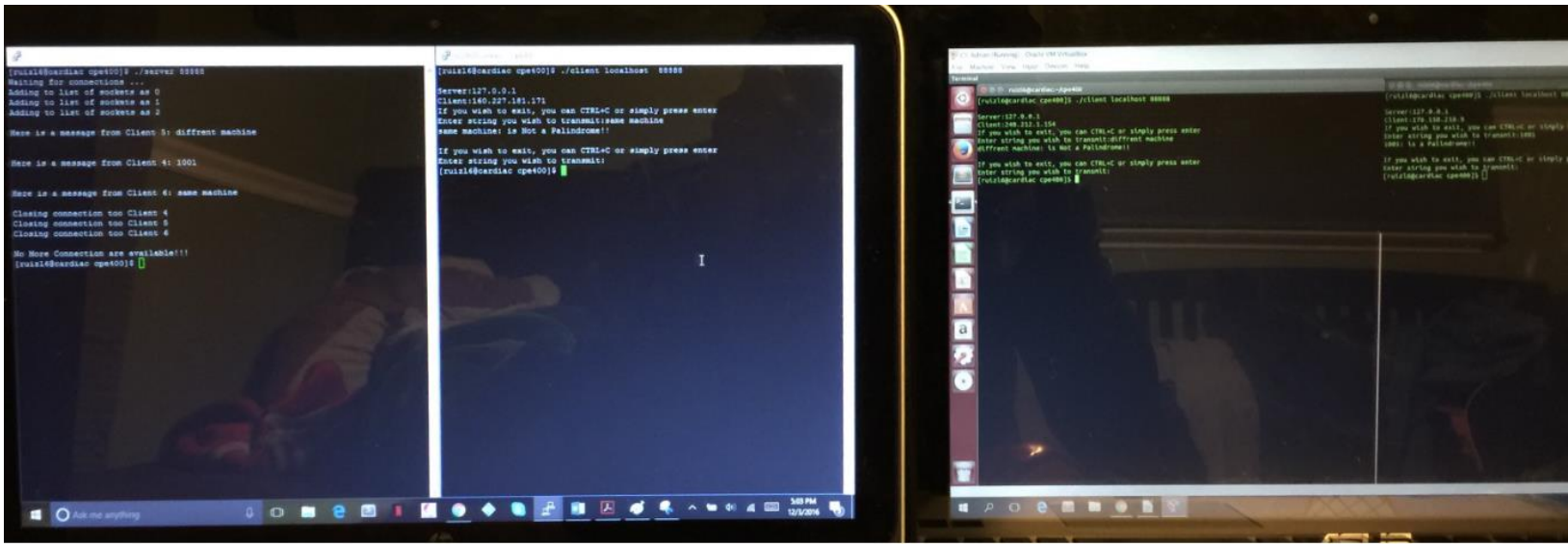
Images:



1:Figure display on server and 3 clients, all on the same machine



2:Bottom image are 2 clients from different machines and the top are images are a server and client from my machine



3:An image of the two machines