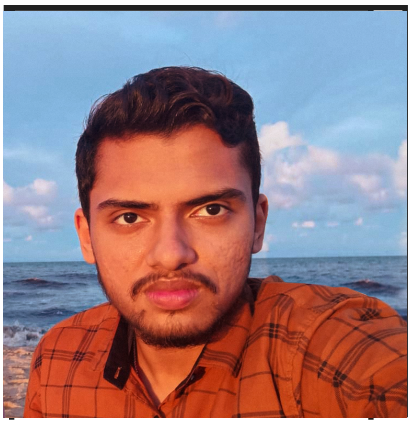
STUDENT PORTFOLIO



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Ex.No:1	STUDY OF HEADER FILES WITH RESPECT TO SOCKET PROGRAMMING
Date:	

AIM:

To Study the header files with respect to Socket Programming

1. **stdio.h:**

Has standard input and output library providing simple and efficient buffered stream IOinterface.(scanf, printf, gets, putc etc.)

2. **unistd.h:**

It is a POSIX standard for open system interface. [Portable Operating System Interface]. (fork, pipe, read, write etc.)

3. **string.h:**

This header file is used to perform string manipulation operations on NULL terminatedstrings.(strcpy,strcmp, strlen etc.)

4. **stdlib.h:**

This header file contains the utility functions such as string conversion routines, memoryallocation routines, random number generator, etc. (abort, exit, rand, atoi etc.)

5. **sys/types.h:**

Defines the data type of socket address structure in unsigned long.(clock_t, size_t, dev_t etc.)

6. **sys/socket.h:**

The socket functions can be defined as taking pointers to the generic socket address structure called sockaddr. (SO_REUSEADDR, SO_ERROR, SO_ACCEPTCONN etc.)

7. **netinet/in.h:**

Defines the IPv4 socket address structure commonly called Internet socket address structure called sockaddr_in. (IPPROTO_IP, IPPROTO_ICMP, IPPROTO_TCP etc.)

8. **netdb.h:**

Defines the structure hostent for using the system call gethostbyname to get the network host entry.(HOST_NOT_FOUND, NO_DATA, NO_RECOVERY etc.)

9. time.h:

Has structures and functions to get the system date and time and to perform time manipulation functions. We use the function ctime(), that is defined in this header file , to calculate the current dateand time.

10. sys/stat.h:

Contains the structure stat to test a descriptor to see if it is of a specified type. Also it is used to display file or file system status.stat() updates any time related fields.when copying from 1 file to another.

11. sys/ioctl.h:

Macros and defines used in specifying an ioctl request are located in this header file. We use the function ioctl() that is defined in this header file. ioctl() function is used to perform ARP cache operations.

12. pcap.h:

Has function definitions that are required for packet capturing. Some of the functions are pcap_lookupdev(),pcap_open_live() and pcap_loop(). pcap_lookupdev() is used to initialize the network device. The device to be sniffed is opened using the pcap_open_live(). Pcap_loop() determines the number of packets to be sniffed.

13. net/if_arp.h:

Contains the definitions for Address Resolution Protocol. We use this to manipulate the ARP request structure and its data members arp_pa,arp_dev and arp_ha. The arp_ha structure's datamember sa_data[ ] has the hardware address.

14. errno.h:

It sets an error number when an error and that error can be displayed using perror function. It has symbolic error names. The error number is never set to zero by any library function.

15. arpa/inet.h:

This is used to convert internet addresses between ASCII strings and network byte ordered binaryvalues (values that are stored in socket address structures). It is used for inet_aton, inet_addr,inet_ntoa functions

Result :

Thus the header files of Socket programs are studied

Ex.No:2	STUDY OF BASIC FUNCTIONS OF SOCKET PROGRAMMING
Date:	

Aim :

To discuss some of the basic functions used for socket programming.

1. man socket

NAME:

Socket – create an endpoint for communication.

SYNOPSIS:

```
#include<sys/types.h>
#include<sys/socket.h>
int socket(int domain,int type,int protocol);
 eg: sd=socket(AF_INET,SOCK_STREAM,0);
```

DESCRIPTION:

- Socket creates an endpoint for communication and returns a descriptor.
- The domain parameter specifies a common domain this selects the protocol family whichwill be used for communication.
- These families are defined in <sys/socket.h>.

FORMAT:

NAME	PURPOSE
PF_UNIX,PF_LOCAL	Local Communication.
PF_INET	IPV4 Internet Protocols.
PF_IPX	IPX-Novell Protocols.
PF_APPLETALK	Apple Talk.

- The socket has the indicated type, which specifies the communication semantics.

TYPES:

1.SOCK_STREAM:

- Provides sequenced , reliable, two-way , connection based byte streams.
- An out-of-band data transmission mechanism, may be supported.

2.SOCK_DGRAM:

- Supports datagram (connectionless, unreliable messages of a fixed

maximum length).

3.SOCK_SEQPACKET:

- Provides a sequenced , reliable, two-way connection based data transmission path fordatagrams of fixed maximum length.

4.SOCK_RAW:

- Provides raw network protocol access.

5.SOCK_RDM:

- Provides a reliable datagram layer that doesn't guarantee ordering.

6.SOCK_PACKET:

- Obsolete and shouldn't be used in new programs.

2. man connect:

NAME:

connect – initiate a connection on a socket.

SYNOPSIS:

```
#include<sys/types.h>
#include<sys/socket.h>
int connect(int sockfd,const (struct
sockaddr*)&serv_addr,socklen_t addrlen);eg:
cd=connect(sd,(struct sockaddr*)&servaddr,sizeof(servaddr));
```

DESCRIPTION:

- The file descriptor sockfd must refer to a socket.
- If the socket is of type SOCK_DGRAM then the serv_addr address is the address to which datagrams are sent by default and the only addr from which datagrams arereceived.
- If the socket is of type SOCK_STREAM or SOCK_SEQPACKET , this call attempts tomake a connection to another socket.

RETURN VALUE:

- If the connection or binding succeeds, zero is returned.
- On error , -1 is returned , and error number is set appropriately.

ERRORS:

EBADF	Not a valid Index.
EFAULT	The socket structure address is outside the user'saddress space.
ENOTSOCK	Not associated with a socket.
EISCONN	Socket is already connected.
ECONNREFUSED	No one listening on the remote address.

3. man accept

NAME:

accept/reject job is sent to a destination.

SYNOPSIS:

accept destination(s)
reject[-t] [-h server] [-r reason] destination(s)
eg: ad=accept(sd,(struct sockaddr*)&cliaddr,&clilen);

DESCRIPTION:

- accept instructs the printing system to accept print jobs to the specified destination.
- The –r option sets the reason for rejecting print jobs.
- The –e option forces encryption when connecting to the server.

4. man send

NAME:

send, sendto, sendmsg - send a message from a socket.

SYNOPSIS:

#include<sys/types.h>
#include<sys/socket.h>
ssize_t send(int s, const void *buf, size_t len, int flags);
ssize_t sendto(int s, const void *buf, size_t len, int flags, const struct sock_addr*to, socklen_t tolen);ssize_t sendmsg(int s, const struct msghdr *msg, int flags);

DESCRIPTION:

- The system calls send, sendto and sendmsg are used to transmit a message to anothersocket.
- The send call may be used only when the socket is in a connected state.
- The only difference between send and write is the presence of flags.
- The parameter is the file descriptor of the sending socket.

5. man recv

NAME:

recv, recvfrom, recvmsg – receive a message from a socket.

SYNOPSIS:

#include<sys/types.
h>
#include<sys/socke
t.h>

ssize_t recv(int s, void *buf, size_t len, int flags);
ssize_t recvfrom(int s, void *buf, size_t len, int flags, struct sockaddr *from,
socklen_t* from len);ssize_t recvmsg(int s, struct msghdr *msg, int flags);

DESCRIPTION:

- The recvfrom and recvmsg calls are used to receive messages from a socket, and may beused to recv data on a socket whether or not it is connection oriented.
- If from is not NULL, and the underlying protocol provides the src addr , this src addr isfilled in.
- The recv call is normally used only on a connection socket and is identical to recvfromwith a NULL from parameter.

6. man write

NAME:

write- send a message to another user.

SYNOPSIS:

write user[ttyname]

DESCRIPTION:

- write allows you to communicate with other users, by copying lines from terminal to
  ……
- When you run the write and the user you are writing to get a message of the form:Message from yourname @yourhost on yourtty at hh:mm:…
- Any further lines you enter will be copied to the specified user's terminal.
- If the other user wants to reply they must run write as well.

7. ifconfig

NAME:

ifconfig- configure a network interface.

SYNOPSIS:

ifconfig[interface]
ifconfig interface[aftype] options | address……

DESCRIPTION:

- ifconfig is used to configure the kernel resident network interfaces.
- It is used at boot time to setup interfaces as necessary.
- After that, it is usually only needed when debugging or when system tuning is needed.
- If no arguments are given, ifconfig displays the status of the currently active interfaces.

8. man bind

SYNOPSIS:

bind[-m keymap] [-lp sv psv]

9. man htons/ man

htonlNAME:

htonl, htons, ntohl, ntohs - convert values between host and network byte order.

SYNOPSIS:

```
#include<netinet/in.h>
uint32_t htonl(uint32_t
hostlong); uint16_t
        htons(uint32_t
hostshort);uint32_t
        ntohl(uint32_t
netlong); uint16_t
        ntohs(uint16_t
netshort);
```

DESCRIPTION:

- The htonl() function converts the unsigned integer hostlong from host byte order tonetwork byte order.
- The htons() converts the unsigned short integer hostshort from host byte order to networkbyte order.

- The ntohl() converts the unsigned integer netlong from network byte order to host byteorder.

10.man

gethostname

NAME:

gethostname, sethostname- get/set host name.

SYNOPSIS:

```
#include<unistd.h>
int gethostname(char *name,size_t len);
int sethostname(const char *name,size_t len);
```

DESCRIPTION:

- These functions are used to access or to change the host name of the current processor.
- The gethostname() returns a NULL terminated hostname(set earlier by sethostname()) inthe array name that has a length of len bytes.
- In case the NULL terminated then hostname does not fit ,no error is returned, but thehostname is truncated.
- It is unspecified whether the truncated hostname will be NULL terminated.

11.man

gethostbyname

NAME:

gethostbyname, gethostbyaddr, sethostent, endhostent, herror, hstr – error – get network host entry.

SYNOPSIS:

```
#include<netdb.
  h> extern int
  h_errno;
  struct hostent *gethostbyname(const char
*name);#include<sys/socket.h>
```

struct hostent *gethostbyaddr(const char *addr)int len,
int type);struct hostent *gethostbyname2(const char
*name,int af);

DESCRIPTION:

- The gethostbyname() returns a structure of type hostent for the given hostname.
- Name->hostname or IPV4/IPV6 with dot notation.
- gethostbyaddr()- struct of type hostent / host address length
- Address types- AF_INET, AF_INET6.
- sethostent() – stay open is true(1).
- TCP socket connection should be open during queries.
- Server queries for UDP datagrams.
- endhostent()- ends the use of TCP connection.
- Members of hostent structure:
    a) h_name
    b) h_aliases
    c) h_addrtype
    d) h_length
    e) h_addr-list
    f) h_addr.

RESULT:

Thus the basic functions used for Socket Programming was studied successfully.

Ex.No:3	SIMPLE TCP/IP CLIENT SERVER COMMUNICATION
Date:	

Aim:

There are two hosts, Client and Server. The Client accepts the message from the user and sends it to the Server. The Server receives the message and prints it.

TECHNICAL OBJECTIVE:

To implement a simple TCP Client-Server application , where the Client on establishing a connection with the Server, sends a string to the Server. The Server reads the String and prints it.

METHODOLOGY:

Server:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET, sin_addr to INADDR_ANY, sin_port to a dynamically assigned port number.
- Bind the local host address to socket using the bind function.
- Listen on the socket for connection request from the client.
- Accept connection request from the client using accept function.
- Within an infinite loop, using the recv function receive message from the client and print it on the console.

Client:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET.
- Get the server IP address and port number from the console.
- Using gethostbyname function assign it to a hostent structure, and assign it to sin_addr of the server address structure.
- Request a connection from the server using the connect function.
- Within an infinite loop, read message from the console and send the message to the server using the send function.

CODING:

Server: tcpserver.c

```
#include<sys/types.h>
#include<sys/socket.h>
#include<netinet/in.h>
#include<netdb.h>
#include<arpa/inet.h>
#include<string.h>
#include<string.h>
#include<stdio.h>
int main(int asrgc,char*argv[])
{
```

```
        int bd,sd,ad;
        char buff[1024];
        struct sockaddr_in cliaddr,servaddr;
        socklen_t clilen;
        clilen=sizeof(cliaddr);
        bzero(&servaddr,sizeof(servaddr));
```

/*Socket address structure*/

```
        servaddr.sin_family=AF_INET;
        servaddr.sin_addr.s_addr=htonl(INADDR_ANY);
        servaddr.sin_port=htons(1999);
```

/*TCP socket is created, an Internet socket address structure is filled with wildcard address & server's well known port*/

```
        sd=socket(AF_INET,SOCK_STREAM,0);
```

/*Bind function assigns a local protocol address to the socket*/

```
        bd=bind(sd,(struct sockaddr*)&servaddr,sizeof(servaddr));
```

/*Listen function specifies the maximum number of connections that kernel should queue for this socket*/

```
        listen(sd,5);
        printf("Server is running….\n");
```

/*The server to return the next completed connection from the front of the completed connection Queue calls it*/

```
        ad=accept(sd,(struct sockaddr*)&cliaddr,&clilen);
    while(1)
    {
        bzero(&buff,sizeof(buff));
```

/*Receiving the request message from the client*/

```
        recv(ad,buff,sizeof(buff),0);
        printf("Message received is %s\n",buff);
    }
}
```

Client: tcpclient.c

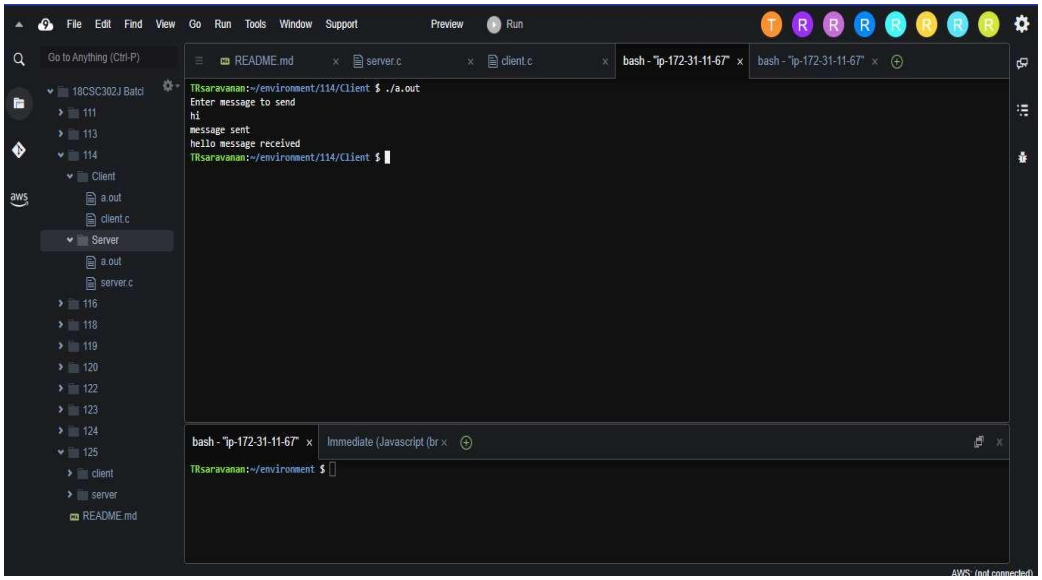
```
#include<stdio.h>
#include<string.h>
#include<sys/socket.h>
#include<sys/types.h>
#include<unistd.h>
#include<netinet/in.h>
#include<netdb.h>
#include<arpa/inet.h>
int main(int argc,char * argv[])
{
        int cd,sd,ad;
        char buff[1024];
        struct sockaddr_in cliaddr,servaddr;
        struct hostent *h;
```

/*This function looks up a hostname and it returns a pointer to a hostent structure that contains all the IPV4 address*/

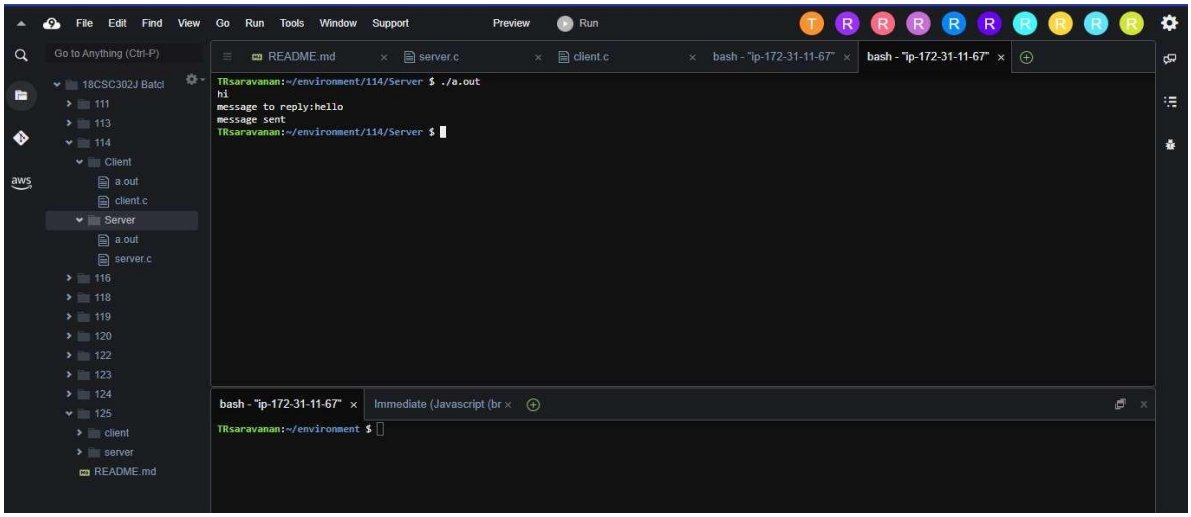
```
        h=gethostbyname(argv[1]);
        bzero(&servaddr,sizeof(servaddr));

    /*Socket address structure*/
        servaddr.sin_family=AF_INET;
        memcpy((char *)&servaddr.sin_addr.s_addr,h->h_addr_list[0],h->h_length);
        servaddr.sin_port = htons(1999);

   /*Creating a socket, assigning IP address and port number for that socket*/
        sd = socket(AF_INET,SOCK_STREAM,0);

    /*Connect establishes connection with the server using server IP address*/
        cd=connect(sd,(struct sockaddr*)&servaddr,sizeof(servaddr));
    while(1)
    {
       printf("Enter the message: \n");

        /*Reads the message from standard input*/
        fgets(buff,100,stdin);

      /*Send function is used on client side to send data given by user on client
      side to the server*/
        send(sd,buff,sizeof(buff)+1,0);
        printf("\n Data Sent ");
        //recv(sd,buff,strlen(buff)+1,0);
        printf("%s",buff);
        }
}
```

OUTPUT :

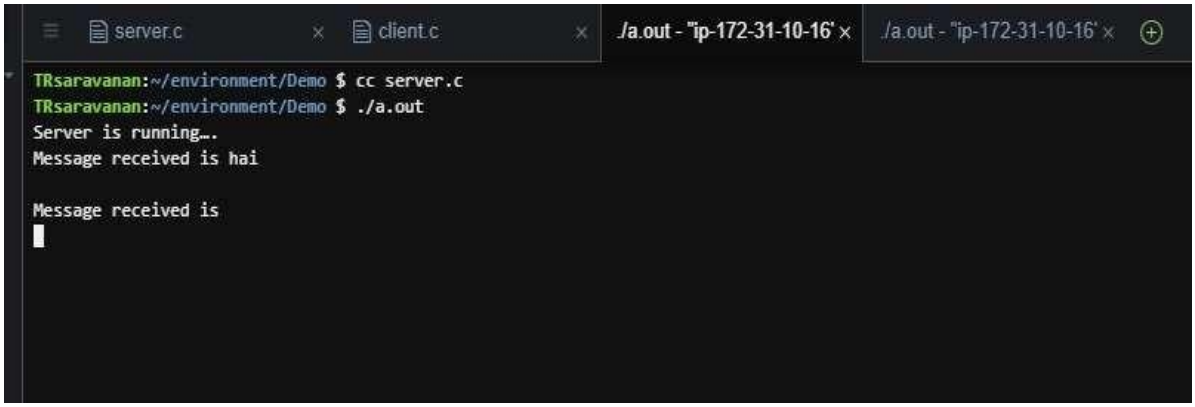
Client Output:

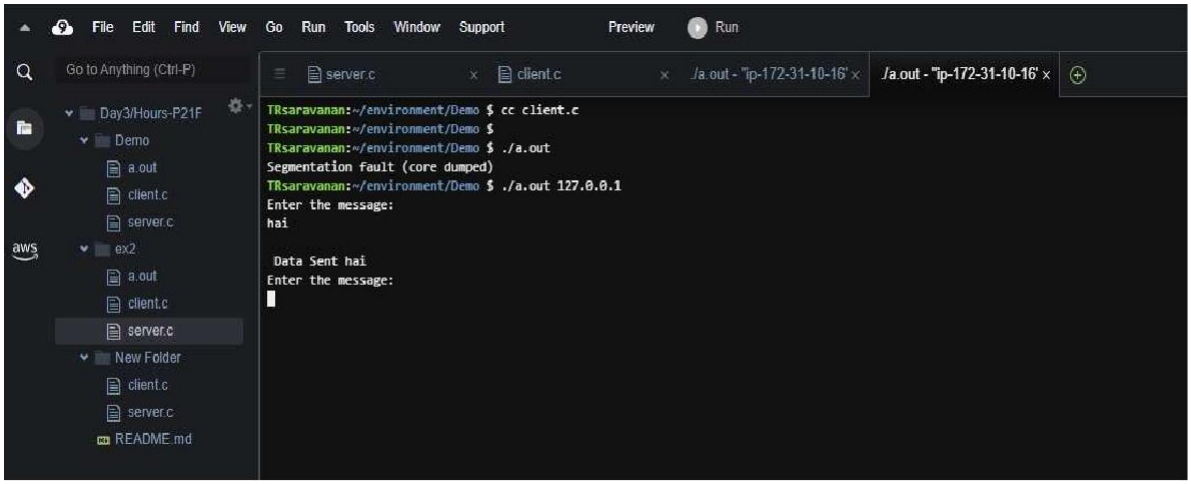


Server Output:



Execution Procedure when we receive Segmentation Fault:





RESULT: Hence, the TPC/IP server client experiment is studied and performed.

Ex.No:3	UDP ECHO CLIENT SERVER COMMUNICATION
Date:	

Aim:

There are two hosts, Client and Server. The Client accepts the message from the user and sends it to the Server. The Server receives the message, prints it and echoes the message back to the Client.

TECHNICAL OBJECTIVE:

To implement an UDP Echo Client-Server application , where the Client on establishing a connection with the Server, sends a string to the Server. The Server reads the String, prints it and echoes it back to the Client.

METHODOLOGY:

Server:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_DGRAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET, sin_addr to INADDR_ANY, sin_port to SERVER_PORT, a macro defined port number.
- Bind the local host address to socket using the bind function.
- Within an infinite loop, receive message from the client using recvfrom function, print it on the console and send (echo) the message back to the client using sendto function.

Client:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_DGRAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET.
- Get the server IP address from the console.
- Using gethostbyname function assign it to a hostent structure, and assign it to sin_addr of the server address structure.
- Within an infinite loop, read message from the console and send the message to the server using the sendto function.
- Receive the echo message using the recvfrom function and print it on the console.

CODING:

Server:

```
#include<sys/socket.h>
#include<stdio.h>
#include<unistd.h>
#include<string.h>
#include<netinet/in.h>
#include<netdb.h>
#include<arpa/inet.h>
#include<sys/types.h>
int main(int argc,char *argv[])
{
        int sd;
```

```
        char buff[1024];
        struct sockaddr_in cliaddr,servaddr;
        socklen_t clilen;
        clilen=sizeof(cliaddr);

/*UDP socket is created, an Internet socket address structure is filled with wildcard
address & server's well known port*/
        sd=socket(AF_INET,SOCK_DGRAM,0);
if (sd<0)
{
        perror ("Cannot open Socket");
        exit(1);
 }
        bzero(&servaddr,sizeof(servaddr));
 /*Socket address structure*/
        servaddr.sin_family=AF_INET;
        servaddr.sin_addr.s_addr=htonl(INADDR_ANY);
        servaddr.sin_port=htons(5669);

 /*Bind function assigns a local protocol address to the socket*/
 if(bind(sd,(struct sockaddr*)&servaddr,sizeof(servaddr))<0)
 {
      perror("error in binding the port");
      exit(1);
 }
        printf("%s","Server is Running…\n");
 while(1)
 {
        bzero(&buff,sizeof(buff));

         /*Read the message from the client*/
        if(recvfrom(sd,buff,sizeof(buff),0,(struct sockaddr*)&cliaddr,&clilen)<0)
        {
                perror("Cannot rec data");
                exit(1);
         }
        printf("Message is received \n",buff);

        /*Sendto function is used to echo the message from server to client side*/
        if(sendto(sd,buff,sizeof(buff),0,(struct sockadddr*)&cliaddr,clilen)<0)
        {
                perror("Cannot send data to client");
                exit(1);
        }
         printf("Send data to UDP Client: %s",buff);
 }
 cloSe(sd);
 return 0;
}
```

Client:

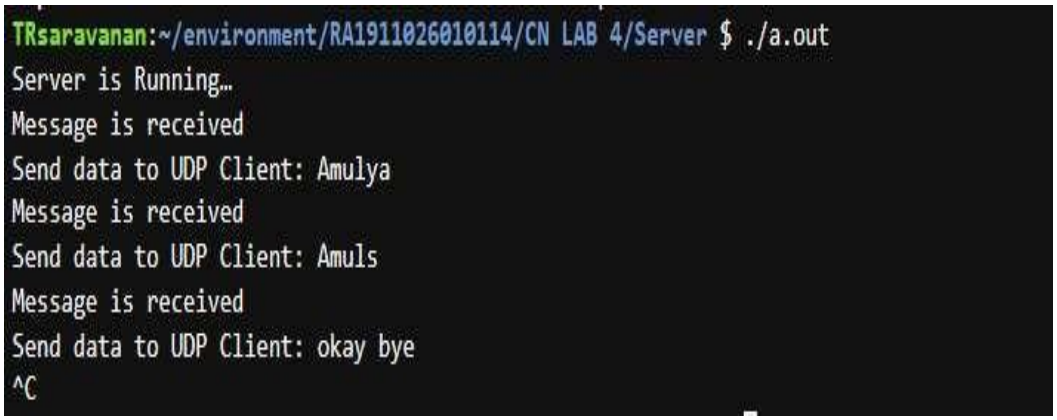
```
#include<sys/types.h>
#include<sys/socket.h>
#include<stdio.h>
#include<unistd.h>
#include<string.h>
#include<netinet/in.h>
#include<netdb.h>
int main(int argc,char*argv[])
{
        int sd;
        char buff[1024];
        struct sockaddr_in servaddr;
        socklen_t len;
        len=sizeof(servaddr);

/*UDP socket is created, an Internet socket address structure is filled with
wildcard address & server's well known port*/
        sd = socket(AF_INET,SOCK_DGRAM,0);
 if(sd<0)
 {
        perror("Cannot open socket");
        exit(1);
 }
        bzero(&servaddr,len);

 /*Socket address structure*/
        servaddr.sin_family=AF_INET;
        servaddr.sin_addr.s_addr=htonl(INADDR_ANY);
        servaddr.sin_port=htons(5669);
 while(1)
 {
        printf("Enter Input data : \n");
        bzero(buff,sizeof(buff));

         /*Reads the message from standard input*/
        fgets(buff,sizeof (buff),stdin);

         /*sendto is used to transmit the request message to the server*/
        if(sendto (sd,buff,sizeof (buff),0,(struct sockaddr*)&servaddr,len)<0)
        {
                perror("Cannot send data");
                exit(1);
         }
        printf("Data sent to UDP Server:%s",buff);
        bzero(buff,sizeof(buff));
        /*Receiving the echoed message from server*/
        if(recvfrom (sd,buff,sizeof(buff),0,(struct sockaddr*)&servaddr,&len)<0)
         {
                perror("Cannot receive data");
               exit(1);
         }
```

```
            printf("Received Data from server: %s",buff);
        }
            close(sd);
            return 0;
    }
```

Sample Output:

Server :

Client :



Result :

Thus, the UDP ECHO client server communication is established by sending the message from the client to the server and server prints it and echoes the message back to the client.

Ex.No:5	CONCURRENT TCP/IP DAY-TIME SERVER
Date:	

Aim:

There are two hosts, Client and Server. The Client requests the concurrent server for the date and time. The Server sends the date and time, which the Client accepts and prints.

TECHNICAL OBJECTIVE:

To implement a TCP/IP day time server (concurrent server) that handles multiple client requests. Once the client establishes connection with the server, the server sends its day-time details to the client which the client prints in its console.

METHODOLOGY:

TCP Server :

- Create Socket address structure.
- TCP/UDP socket is created, an Internet socket address structure is filled with wildcard address & server's well known port.
- Bind function assigns a local protocol address to the socket.
- Listen function specifies the maximum number of connections that kernel should queue for this socket.
- The server to return the next completed connection from the front of the completed connection Queue calls it.
- Receiving the request message from the client.

TCP Client :

- This function looks up a hostname and it returns a pointer to a hostent structure that contains all the IPV4 address.
- Create Socket address structure. Creating a socket, assigning IP address and port number for that socket.
- Connect establishes connection with the server using server IP address.
- Reads the message from standard input.
- Send function is used on client side to send data given by user on client side to the server.

Server:

```
#include<netinet/in.h>
#include<sys/socket.h>
#include<stdio.h>
#include<string.h>
#include<time.h>
#include<stdlib.h>
int main()
{
        struct sockaddr_in sa;
        struct sockaddr_in cli;
```

```
        int sockfd,conntfd;
        int len,ch;
        char str[100];
        time_t tick;
        sockfd=socket(AF_INET,SOCK_STREAM,0);
    if(sockfd<0)
    {
        printf("error in socket\n");
        exit(0);
    }
    else
        printf("Socket opened");
        bzero(&sa,sizeof(sa));
        sa.sin_port=htons(5600);
        sa.sin_addr.s_addr=htonl(0);
    if(bind(sockfd,(struct sockaddr*)&sa,sizeof(sa))<0)
    {
        printf("Error in binding\n");
    }
    else
        printf("Binded Successfully");
        listen(sockfd,50);
    for(;;)
    {
        len=sizeof(ch);
        conntfd=accept(sockfd,(struct sockaddr*)&cli,&len);
        printf("Accepted");
        tick=time(NULL);
        snprintf(str,sizeof(str),"%s",ctime(&tick));
        printf("%s",str);write(conntfd,str,100);
    }
    }
```

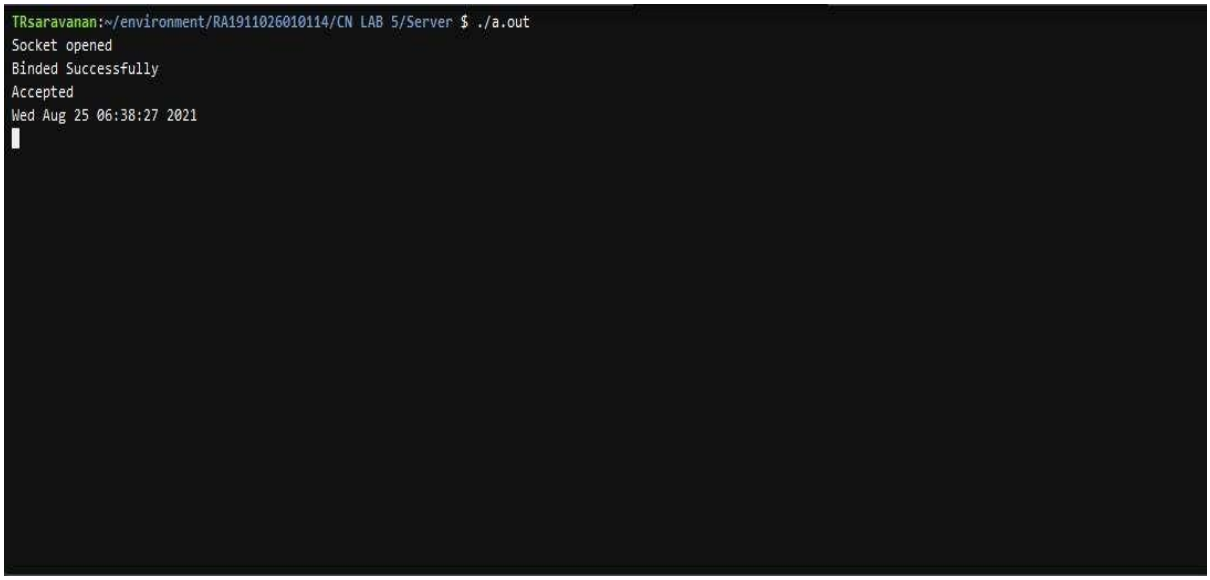
Client:

```
    #include <netinet/in.h>
    #include <sys/socket.h>
    #include <stdio.h>
    #include <stdlib.h>
    int main()
    {
        struct sockaddr_in sa,cli;
        int n,sockfd;
        int len;char buff[100];
        sockfd=socket(AF_INET,SOCK_STREAM,0);
        if(sockfd<0)
    {
```

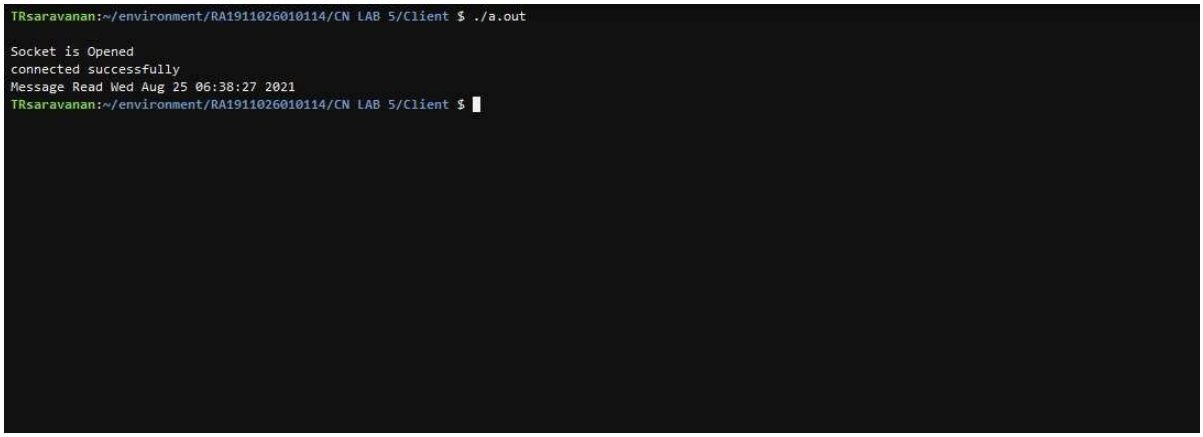
```
            printf("\nError in Socket");
            exit(0);
    }
    else
            printf("\nSocket is Opened");
            bzero(&sa,sizeof(sa));
            sa.sin_family=AF_INET;
            sa.sin_port=htons(5600);
    if(connect(sockfd,(struct sockaddr*)&sa,sizeof(sa))<0)
    {
            printf("\nError in connection failed");
            exit(0);
    }
    else
            printf("\nconnected successfully");
    if(n=read(sockfd,buff,sizeof(buff))<0)
    {
            printf("\nError in Reading");
            exit(0);
    }
    else
    {
            printf("\nMessage Read %s",buff);
    }
    }
```

Sample Output:

Server Side :



Client Side :



Result :

Thus the concurrent daytime client- server communication is established by sending the request message from the client to the concurrent server and the server sends its time to all the clients and displays it.

Ex.No:6	HALF DUPLEX CHAT USING TCP/IP
Date:	

Aim :

There are two hosts, Client and Server. Both the Client and the Server exchange message i.e. they send messages or receive message from the other. There is only a single way communication between them.

TECHNICAL OBJECTIVE:

To implement a half duplex application, where the Client establishes a connection with the Server. The Client can send and the server well receive messages at the same time.

Server:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET, sin_addr to INADDR_ANY, sin_port to dynamically assigned port number.
- Bind the local host address to socket using the bind function.
- Listen on the socket for connection request from the client.
- Accept connection request from the Client using accept function.
- Fork the process to receive message from the client and print it on the console.
- Read message from the console and send it to the client.

Client:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET.
- Get the server IP address and the Port number from the console.
- Using gethostbyname function assign it to a hostent structure, and assign it to sin_addr of the server address structure.
- Request a connection from the server using the connect function.
- Fork the process to receive message from the server and print it on the console.
- Read message from the console and send it to the server.

Codes:

Server:

```
#include "stdio.h"
#include "stdlib.h"
#include "string.h"
#include <sys/types.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <unistd.h>
#include "netdb.h"
#include "arpa/inet.h"
```

```
#define MAX 1000
#define BACKLOG 5
int main()
{
        char serverMessage[MAX];
        char clientMessage[MAX];
        int  socketDescriptor = socket(AF_INET, SOCK_STREAM, 0);
        struct sockaddr_inserverAddress;
        serverAddress.sin_family = AF_INET;
        serverAddress.sin_port = htons(5214);
        serverAddress.sin_addr.s_addr = INADDR_ANY;
        bind(socketDescriptor, (struct sockaddr*)&serverAddress, sizeof(serverAddress));
        listen(socketDescriptor, BACKLOG);
        int clientSocketDescriptor = accept(socketDescriptor, NULL, NULL);
while (1)
{
        printf("\ntext message here .. :");
        scanf("%s", serverMessage);
        send(clientSocketDescriptor, serverMessage, sizeof(serverMessage) , 0);
        recv(clientSocketDescriptor, &clientMessage, sizeof(clientMessage), 0) ;
        printf("\nCLIENT: %s", clientMessage);

 }
        close(socketDescriptor);
        return 0;
}
```

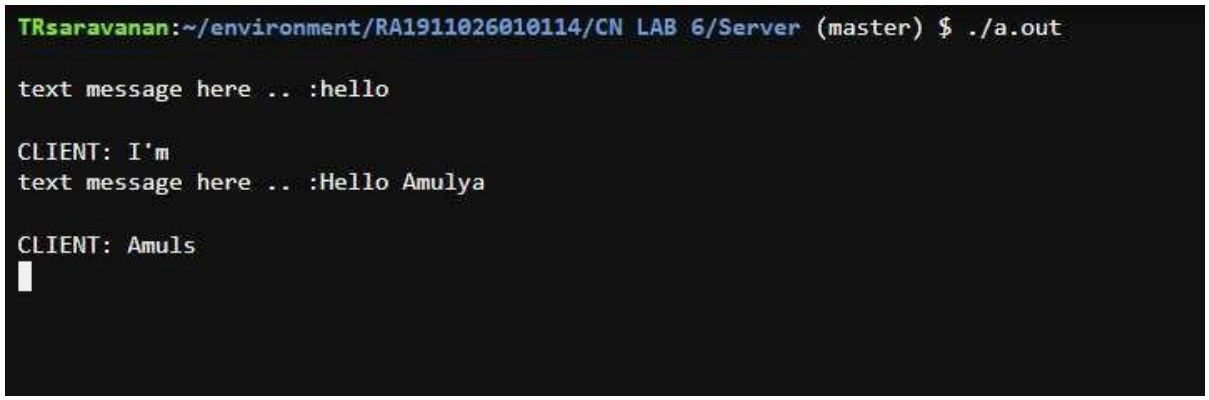
Client:

```
#include "stdio.h"
#include "stdlib.h"
#include "string.h"
#include <sys/types.h>
#include <sys/socket.h>
include <netinet/in.h>
#include <unistd.h>
#include "netdb.h"
#include "arpa/inet.h"
#define h_addrh_addr_list[0]
#define PORT 5214
#define MAX 1000
int main(){
char clientResponse[MAX];
int socketDescriptor = socket(AF_INET, SOCK_STREAM, 0);
char hostname[MAX], ipaddress[MAX];
struct hostent *hostIP;
f(gethostname(hostname,sizeof(hostname))==0){
        hostIP = gethostbyname(hostname);
}
else{
        printf("ERROR:FCC4539 IP Address Not ");
}
struct sockaddr_inserverAddress;
serverAddress.sin_family = AF_INET;
```

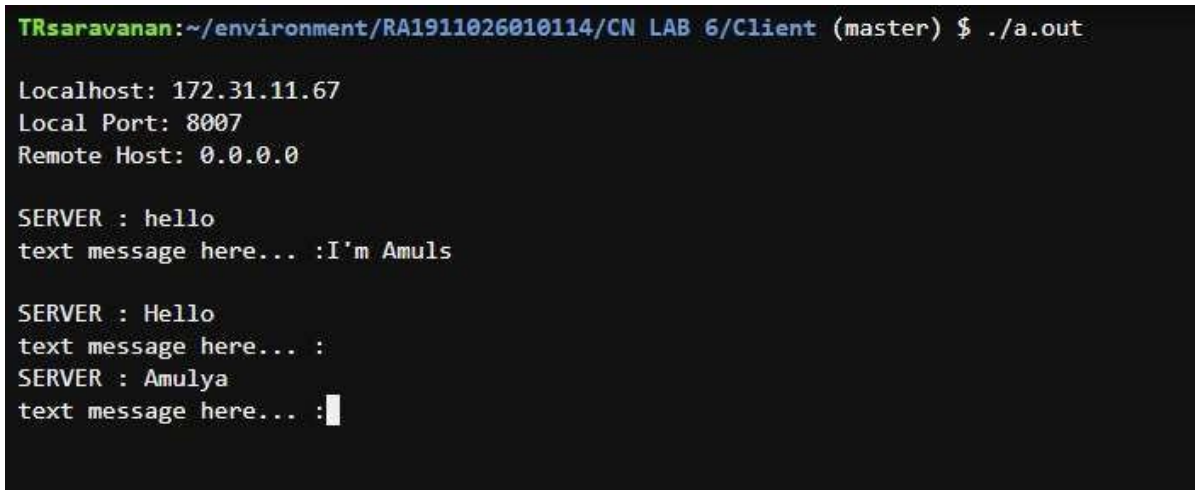
```
serverAddress.sin_port = htons(PORT);
serverAddress.sin_addr.s_addr = INADDR_ANY;
connect(socketDescriptor, (struct sockaddr *)&serverAddress, sizeof(serverAddress));
printf("\nLocalhost: %s\n", inet_ntoa(*(struct in_addr*)hostIP->h_addr));
printf("Local Port: %d\n", PORT);
printf("Remote Host: %s\n", inet_ntoa(serverAddress.sin_addr));
while (1)
{
        recv(socketDescriptor, serverResponse, sizeof(serverResponse), 0);
        printf("\nSERVER : %s", serverResponse);
        printf("\ntext message here... :");
        scanf("%s", clientResponse);
        send(socketDescriptor, clientResponse, sizeof(clientResponse), 0);
}
close(socketDescriptor);
return 0;
}
```

Sample Output:

Server:



Client:



Result :

Thus the chat application full duplex communication is established by sending the request from the client to the server, server gets the message and gives response to the client and prints it.

Ex.No:7	FULL DUPLEX CHAT USING TCP/IP
Date:	

Aim:

There are two hosts, Client and Server. Both the Client and the Server exchange message i.e. they send messages to and receive message from the other. There is a two way communication between them.

TECHNICAL OBJECTIVE:

To implement a full duplex application, where the Client establishes a connection with the Server. The Client and Server can send as well as receive messages at the same time. Both the Client and Server exchange messages.

Algorithm :

Server:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET, sin_addr to INADDR_ANY, sin_port to dynamically assigned port number.
- Bind the local host address to socket using the bind function.
- Listen on the socket for connection request from the client.
- Accept connection request from the Client using accept function.
- Fork the process to receive message from the client and print it on the console.
- Read message from the console and send it to the client.

Client:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET.
- Get the server IP address and the Port number from the console.
- Using gethostbyname function assign it to a hostent structure, and assign it to sin_addr of the server address structure.
- Request a connection from the server using the connect function.
- Fork the process to receive message from the server and print it on the console.
- Read message from the console and send it to the server.

Codes:

Server:

```
#include<sys/types.h>
#include<sys/socket.h>
#include<stdio.h>
#include<unistd.h>
#include<netdb.h>
#include<arpa/inet.h>
#include<netinet/in.h>
#include<string.h>
```

```
int main(int argc,char *argv[])
{
        int clientSocketDescriptor,socketDescriptor;
        struct sockaddr_inserverAddress,clientAddress;
        socklen_tclientLength;
        char recvBuffer[8000],sendBuffer[8000];
        pid_tcpid;
        bzero(&serverAddress,sizeof(serverAddress));
        /*Socket address structure*/
        serverAddress.sin_family=AF_INET;
        serverAddress.sin_addr.s_addr=htonl(INADDR_ANY);
        serverAddress.sin_port=htons(9652);
        /*TCP socket is created, an Internet socket address structure is filled with
        wildcard address & server's well known port*/
        socketDescriptor=socket(AF_INET,SOCK_STREAM,0);
        /*Bind function assigns a local protocol address to the socket*/
        bind(socketDescriptor,(struct sockaddr*)&serverAddress,sizeof(serverAddress));
        /*Listen function specifies the maximum number of connections that kernel should queue
        for this socket*/
        listen(socketDescriptor,5);
        printf("%s\n","Server is running ...");
        /*The server to return the next completed connection from the front of the
        completed connection Queue calls it*/
        clientSocketDescriptor=accept(socketDescriptor,(struct
        sockaddr*)&clientAddress,&clientLength);
        /*Fork system call is used to create a new process*/
        cpid=fork();
        if(cpid==0)
        {
                while(1)
                {
                        bzero(&recvBuffer,sizeof(recvBuffer));
                        /*Receiving the request from client*/
                        recv(clientSocketDescriptor,recvBuffer,sizeof(recvBuffer),0);
                        printf("\nCLIENT : %s\n",recvBuffer);
                }
        }
        else
        {
        while(1)
        {
                bzero(&sendBuffer,sizeof(sendBuffer));
                printf("\nType a message here ...  ");
                /*Read the message from client*/
```

```
                fgets(sendBuffer,80000,stdin);
                /*Sends the message to client*/
                send(clientSocketDescriptor,sendBuffer,strlen(sendBuffer)+1,0);
                printf("\nMessage sent !\n");
        }
        }
        return 0;
        }
```

Client:

```
        #include "stdio.h"
        #include "stdlib.h"
        #include "string.h"
        //headers for socket and related functions
        #include <sys/types.h>
        #include <sys/socket.h>
        //for including structures which will store information needed
        #include <netinet/in.h>
        #include <unistd.h>
        //for gethostbyname
        #include "netdb.h"
        #include "arpa/inet.h"
        int main()
        {
                int socketDescriptor;
                struct sockaddr_inserverAddress;
                char sendBuffer[8000],recvBuffer[8000];
                pid_tcpid;
                bzero(&serverAddress,sizeof(serverAddress));
                serverAddress.sin_family=AF_INET;
                serverAddress.sin_addr.s_addr=inet_addr("127.0.0.1");
                serverAddress.sin_port=htons(9652);
                /*Creating a socket, assigning IP address and port number for that socket*/
                socketDescriptor=socket(AF_INET,SOCK_STREAM,0);
                /*Connect establishes connection with the server using server IP address*/
                connect(socketDescriptor,(struct sockaddr*)&serverAddress,sizeof(serverAddress));
                /*Fork is used to create a new process*/
                cpid=fork();
                if(cpid==0)
                {
                        while(1)
                        {
                                bzero(&sendBuffer,sizeof(sendBuffer));
                                printf("\nType a message here ...  ");
                                /*This function is used to read from server*/
                                fgets(sendBuffer,80000,stdin);
```

```
                        /*Send the message to server*/
                        send(socketDescriptor,sendBuffer,strlen(sendBuffer)+1,0);
                        printf("\nMessage sent !\n");
        }
        }
        else
        {
                while(1)
                {
                        bzero(&recvBuffer,sizeof(recvBuffer));
                        /*Receive the message from server*/
                        recv(socketDescriptor,recvBuffer,sizeof(recvBuffer),0);
                        printf("\nSERVER : %s\n",recvBuffer);
                }
        }
        return 0;
        }
```

Output:

Server:

```
RA1911026010118:~/environment/RA1911026010114/CN LAB 7/Server (master) $ cc server.c
RA1911026010118:~/environment/RA1911026010114/CN LAB 7/Server (master) $ ./a.out
Server is running ...

Type a message here ...
CLIENT : hello


CLIENT : amuls
```

Client:

```
RA1911026010118:~/environment/RA1911026010114/CN LAB 7/Client (master) $ cc client.c
RA1911026010118:~/environment/RA1911026010114/CN LAB 7/Client (master) $ ./a.out

Type a message here ...  hello

Message sent !

Type a message here ...  amuls

Message sent !

Type a message here ...
```

Result:

Thus the chat application full duplex communication is established by sending the request from the client to the server, server gets the message and gives response to the client and prints it.

Ex.No:8	IMPLEMENTATION OF FILE TRANSFER PROTOCOL
Date:	

Aim :

There are two hosts, Client and Server. The Client sends the name of the file it needs from the Server and the Server sends the contents of the file to the Client, where it is stored in a file.

TECHNICAL OBJECTIVE:

To implement FTP application, where the Client on establishing a connection with the Server sends the name of the file it wishes to access remotely. The Server then sends the contents of the file to the Client, where it is stored.

METHODOLOGY:

Server :

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET, sin_addr to INADDR_ANY, sin_port to dynamically assigned port number.
- Bind the local host address to socket using the bind function.
- Listen on the socket for connection request from the client.
- Accept connection request from the Client using accept function.
- Within an infinite loop, receive the file from the client.
- Open the file, read the file contents to a buffer and send the buffer to the Client.

TCP Client :

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_STREAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin_family to AF_INET, sin_addr to INADDR_ANY, sin_port to dynamically assigned port number.
- Bind the local host address to socket using the bind function.
- Listen on the socket for connection request from the client.
- Accept connection request from the Client using accept function.
- Within an infinite loop, send the name of the file to be viewed to the Server.
- Read the file contents, store it in a file and print it on the console.

Codes :

Server:

```
#include "stdio.h"
#include "stdlib.h"
#include "string.h"
//headers for socket and related functions
#include <sys/types.h>
```

```
#include <sys/socket.h>
#include <sys/stat.h>
//for including structures which will store information needed
#include <netinet/in.h>
#include <unistd.h>
//for gethostbyname
#include "netdb.h"
#include "arpa/inet.h"
// defining constants
#define PORT 6969
#define BACKLOG 5
int main()
{
        int size;
        int socketDescriptor = socket(AF_INET, SOCK_STREAM, 0);
        struct sockaddr_in serverAddress, clientAddress;
        socklen_t clientLength;
        struct stat statVariable;
        char buffer[100], file[1000];
        FILE *filePointer;
        bzero(&serverAddress, sizeof(serverAddress));
       serverAddress.sin_family = AF_INET;
       serverAddress.sin_addr.s_addr = htonl(INADDR_ANY);
       serverAddress.sin_port = htons(PORT);
        bind(socketDescriptor, (struct sockaddr *)&serverAddress, sizeof(serverAddress));
       listen(socketDescriptor,BACKLOG);
       printf("%s\n","Server is running ...");
       int clientDescriptor = accept(socketDescriptor,(struct
       sockaddr*)&clientAddress,&clientLength);
       while(1){
               bzero(buffer,sizeof(buffer));
               bzero(file,sizeof(file));
               recv(clientDescriptor,buffer,sizeof(buffer),0);
               filePointer = fopen(buffer,"r");
               stat(buffer,&statVariable);
               size=statVariable.st_size;
               fread(file,sizeof(file),1,filePointer);
               send(clientDescriptor,file,sizeof(file),0);
}
       return 0;
}
```

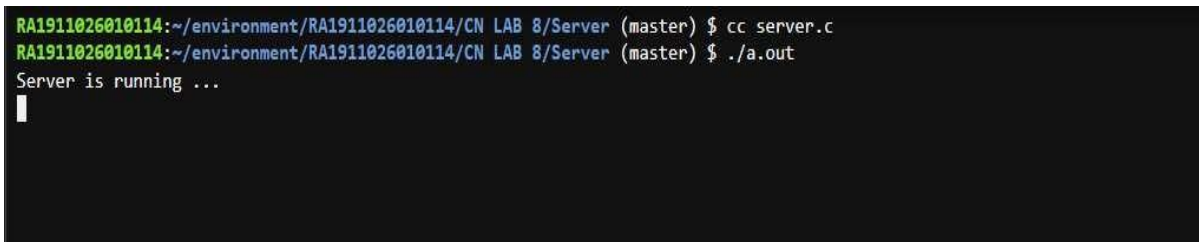
Client:

```
#include "stdio.h"
#include "stdlib.h"
#include "string.h"
```

```
//headers for socket and related functions
#include <sys/types.h>
#include <sys/socket.h>
#include <sys/stat.h>
//for including structures which will store information needed
#include <netinet/in.h>
#include <unistd.h>
//for gethostbyname
#include "netdb.h"
#include "arpa/inet.h"
// defining constants
#define PORT 6969
int main()
{
        int serverDescriptor = socket(AF_INET, SOCK_STREAM, 0);
        struct sockaddr_in serverAddress;
        char buffer[100], file[1000];
        bzero(&serverAddress, sizeof(serverAddress));
        erverAddress.sin_family = AF_INET;
        serverAddress.sin_addr.s_addr = inet_addr("127.0.0.1");
        serverAddress.sin_port = htons(PORT);
        connect(serverDescriptor,(struct sockaddr*)&serverAddress,sizeof(serverAddress));
while (1){
        printf("File name : ");
        scanf("%s",buffer);
        send(serverDescriptor,buffer,strlen(buffer)+1,0);
        printf("%s\n","File Output : ");
        recv(serverDescriptor,&file,sizeof(file),0);
        printf("%s",file);
        }
return 0;
}
```

Output:

Server:



Client:

```
RA1911026010114:~/environment/RA1911026010114/CN LAB 8/Client (master) $ cc client.c
RA1911026010114:~/environment/RA1911026010114/CN LAB 8/Client (master) $ ./a.out
File name : send.txt
File Output :
We are from SRM
File name :
```

Result :

Thus the FTP client-server communication is established and data is transferred between the client and server machines.

Ex.No:9	REMOTE COMMAND EXECUTION USING UDP
Date:	

Aim:

There are two hosts, Client and Server. The Client sends a command to the Server, which executes the command and sends the result back to the Client.

TECHNICAL OBJECTIVE:

Remote Command execution is implemented through this program using which Client is able to execute commands at the Server. Here, the Client sends the command to the Server for remote execution. The Server executes the command and the send result of the execution back to the Client.

METHODOLOGY:

Server:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_DGRAM.
- Initialize server address to 0 using the bzero function.
- Assign the sin _family to AF_INET, sin_addr to INADDR_ANY, sin _port to dynamicallyassigned port number.
- Bind the local host using the bind() system call.
- Within an infinite loop, receive the command to be executed from the client.
- Append text "> temp.txt" to the command.
- Execute the command using the "system()" system call.
- Send the result of execution to the Client using a file buffer.

Client:

- Include the necessary header files.
- Create a socket using socket function with family AF_INET, type as SOCK_DGRAM.
- Initialize server address to O using the bzero function.
- Assign the sin family to AF_INET.
- Get the server IP address and the Port number from the console.
- Using gethostbyname() function assign it to a hostent structure, and assign it to sin_addr of the server address structure.
- Obtain the command to be executed in the server from the user.
- Send the command to the server.
- Receive the output from the server and print it on the console.

Codes:

Server:

```
#include <sys/types.h>
#include <sys/socket.h>
#include <stdio.h>
#include <stdlib.h>
#include <netdb.h>
#include <netinet/in.h>
#include <string.h>
#include <sys/stat.h>
#include <arpa/inet.h>
#include <unistd.h>
#define MAX 1000
int main()
{
        int serverDescriptor = socket(AF_INET, SOCK_DGRAM, 0);
         int size;
        char buffer[MAX], message[] = "Command Successfully executed !";
        struct sockaddr_in clientAddress, serverAddress;
        socklen_t clientLength = sizeof(clientAddress);
        bzero(&serverAddress, sizeof(serverAddress));
        serverAddress.sin_family = AF_INET;
        serverAddress.sin_addr.s_addr = htonl(INADDR_ANY);
        serverAddress.sin_port = htons(8079);
        bind(serverDescriptor, (struct sockaddr *)&serverAddress, sizeof(serverAddress));
while (1)
{
        bzero(buffer, sizeof(buffer));
        recvfrom(serverDescriptor, buffer, sizeof(buffer), 0, (struct sockaddr *)&clientAddress,
        &clientLength);
        system(buffer);
        printf("Command Executed ... %s ", buffer);
        sendto(serverDescriptor, message, sizeof(message), 0, (struct sockaddr *)&clientAddress,
        clientLength);
}
        close(serverDescriptor);
        return 0;
}
```

Client:

```
#include <sys/types.h>
#include <sys/socket.h>
#include <stdio.h>
#include <unistd.h>
```

```
#include <netdb.h>
#include <netinet/in.h>
#include <string.h>
#include <arpa/inet.h>
#define MAX 1000
int main()
{
        int serverDescriptor = socket(AF_INET, SOCK_DGRAM, 0);
        char buffer[MAX], message[MAX];
        struct sockaddr_in cliaddr, serverAddress;
        socklen_t serverLength = sizeof(serverAddress);
        bzero(&serverAddress, sizeof(serverAddress));
        serverAddress.sin_family = AF_INET;
        serverAddress.sin_addr.s_addr = inet_addr("127.0.0.1");
        serverAddress.sin_port = htons(8079);
        bind(serverDescriptor, (struct sockaddr *)&serverAddress, sizeof(serverAddress));
while (1)
{
        printf("\nCOMMAND FOR EXECUTION ... ");
        fgets(buffer, sizeof(buffer), stdin);
        sendto(serverDescriptor, buffer, sizeof(buffer), 0, (struct sockaddr *)&serverAddress,
        serverLength);
        printf("\nData Sent !");
        recvfrom(serverDescriptor, message, sizeof(message), 0, (struct sockaddr
        *)&serverAddress, &serverLength);
        printf("UDP SERVER : %s", message);
}
return 0;
}
```

Output:

Server:

```
RA1911026010114:~/environment/RA1911026010114/CN LAB 9/SERVER (master) $ cc server.c
RA1911026010114:~/environment/RA1911026010114/CN LAB 9/SERVER (master) $ ./a.out
Command Executed ... vi text.txt
a.out  server.c  text.txt
 Command Executed ... ls
Hi my name is Amulya
Nice to meet you.
How are you?
Have a great day.
Bye bye

 Command Executed ... cat text.txt
```

Client:

```
RA1911026010114:~/environment/RA1911026010114/CN LAB 9/CLIENT (master) $ cc client.c
RA1911026010114:~/environment/RA1911026010114/CN LAB 9/CLIENT (master) $ ./a.out

COMMAND FOR EXECUTION ... vi text.txt

Data Sent !UDP SERVER : Command Successfully executed !
COMMAND FOR EXECUTION ... ls

Data Sent !UDP SERVER : Command Successfully executed !
COMMAND FOR EXECUTION ... cat text.txt

Data Sent !UDP SERVER : Command Successfully executed !
COMMAND FOR EXECUTION ...
```

Result :

Thus the Remote Command Execution between the client and server is implemented.

Ex.No:10	ARP IMPLEMENTATION USING UDP
Date:	

Aim :

There is a single host. The IP address of any Client in the network is given as input and the corresponding hardware address is got as the output.

TECHNICAL OBJECTIVE:

Address Resolution Protocol (ARP) is implemented through this program. The IP address of any Client is given as the input. The ARP cache is looked up for the corresponding hardware address. This is returned as the output. Before compiling that Client is pinged.

METHODOLOGY:

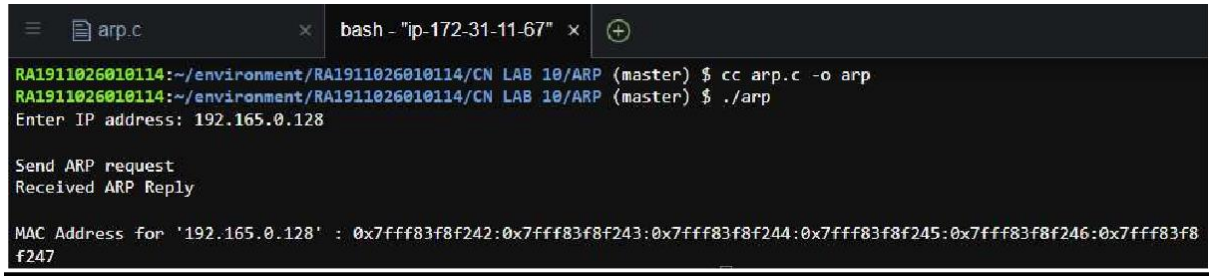
- Start
- Declare the variables and structure for the socket
- Specify the family, protocol, IP address and port number
- Create a socket using socket() function
- Call memcpy() and strcpy functions
- Display the MAC address
- Stop.

Code:

```
#include<sys/types.h>
#include<sys/socket.h>
#include<net/if_arp.h>
#include<sys/ioctl.h>
#include<stdio.h>
#include<string.h>
#include<unistd.h>
#include<math.h>
#include<complex.h>
#include<arpa/inet.h>
#include<netinet/in.h>
#include<netinet/if_ether.h>
#include<net/ethernet.h>
#include<stdlib.h>
int main()
{
        struct sockaddr_in sin={0};
        struct arpreq myarp={{0}};
        unsigned char *ptr;
        int sd;
        sin.sin_family=AF_INET;
        printf("Enter IP address: ");
        char ip[20];
        scanf("%s", ip);
```

```
if(inet_pton(AF_INET,ip,&sin.sin_addr)==0)
{
        printf("IP address Entered '%s' is not valid \n",ip);
        exit(0);
}
memcpy(&myarp.arp_pa,&sin,sizeof(myarp.arp_pa));
strcpy(myarp.arp_dev,"echo");
d=socket(AF_INET,SOCK_DGRAM,0);
printf("\nSend ARP request\n");
if(ioctl(sd,SIOCGARP,&myarp)==1)
{
        printf("No Entry in ARP cache for '%s'\n",ip);
        exit(0);
}
ptr=&myarp.arp_pa.sa_data[0];
printf("Received ARP Reply\n");
printf("\nMAC Address for '%s' : ",ip);
printf("%p:%p:%p:%p:%p:%p\n",ptr,(ptr+1),(ptr+2),(ptr+3),(ptr+4),(ptr+5));
return 0;
}
```

Output:



Result :

Henceforth, Address Resolution Protocol (ARP) is implemented using UDP

Ex.No:11	STUDY OF IPV6 ADDRESSING & SUBNETTING
Date:	

AIM:

To Study the IPV6 Addressing and Subnetting

What is IPv6:

As the number of internet devices—also known as the Internet of Things (IoT)—increases around the world, more IP addresses are needed for these devices to communicate data. Consider smartphones, smartwatches, refrigerators, washing machines, smart TVs, and other electronic devices that require an IP address. All of these devices are now linked to the internet and have a unique IP address assigned to them. We'll focus on IPv6, its characteristics, and why it'll be the Internet Protocol standard in this quick overview.

Before we go into the technicalities, there are a few things to know about IPv6:

1. IPv6 addresses are 128-bit (2128) and allow for 3.4 x 1038 unique IP addresses.
2. IPv6 is written in hexadecimal notation, with the colons separating eight groups of 16 bits, for a total of 8 x 16 = 128, or bits. The following is an example of an IPv6 address:

➢ **Syntax of IPv6 Addresses:**

IPv4 addresses are represented in dotted-decimal format. The 32-bit address is divided along 8-bit boundaries. Each set of 8 bits is converted to its decimal equivalent and separated by periods. In contrast, IPv6 addresses are 128 bits divided along 16-bit boundaries. Each 16-bit block is converted to a 4-digit hexadecimal number and separated by colons. The resulting representation is called colon-hexadecimal.

– The preferred form is x:x:x:x:x:x:x:x, where the x's are the hexadecimal values of the eight 16-bit pieces of the address. For example:

```
FEDC:BA98:7654:3210:FEDC:BA98:7654:3210

1080:0:0:0:8:800:200C:417A
```

➢ **The Addressing Space:**

The amount of memory dedicated to all potential addresses for a computational object, such as a device, a file, a server, or a networked computer, is known as address space. A range of physical or virtual addresses accessible to a processor or reserved for a process is referred to as address space. Each address defines an entity's location as a unique identifier of single entities (unit of memory that can be addressed separately). Each computer device and process is given address space on the computer, which is a piece of the processor's address space. The address space of a processor is always constrained by the width of its address bus and registers. Flat address space, in which addresses are expressed as continuously growing integers starting at zero, and segmented address space, in which addresses are written as discrete segments enhanced by offsets, are the two types of address space (values added to produce secondary addresses). Thunking is a procedure that allows address space to be changed from one format to another in some systems.

In terms of IP address space, there has been concern that IPv4 (Internet Protocol Version 4) had not anticipated the enormous growth of the Internet, and that its 32-bit address space would not be adequate. For that reason, IPv6 has been developed with 128-bit address space.

Allocation of the IPv6 addressing space:

Allocation	Prefix (binary)	Fraction of Address Space
Reserved	0000 0000	1/256
Unassigned	0000 0001	1/256
Reserved for NSAP addresses	0000 001	1/128
Reserved for IPX addresses	0000 010	1/128
Unassigned	0000 011	1/128
Unassigned	0000 1	1/32
Unassigned	0001	1/16
Aggregatable global unicast addresses	001	1/8
Unassigned	010	1/8
Unassigned	011	1/8
Reserved for Geographic-based addresses	100	1/8
Unassigned	101	1/8
Unassigned	110	1/8
Unassigned	1110	1/16
Unassigned	1111 0	1/32
Unassigned	1111 10	1/64
Unassigned	1111 110	1/128
Unassigned	1111 1110 0	1/512
Link Local addresses	1111 1110 10	1/1024

➢ **Types of IPv6 Addresses:**

Generally, IPv6 addresses is classified into 3. They are:

1. Unicast: This type is the address of a single interface. A packet forwarded to a unicast address is delivered only to the interface identified by that address.
2. Anycast: This type is the address of a set of interfaces typically belonging to different nodes. A packet forwarded to an anycast address is delivered to only one interface of the set (the nearest to the source node, according to the routing metric).
3. Multicast: This type is the address of a set of interfaces that typically belong to different nodes. A packet forwarded to a multicast address is delivered to all interfaces belonging to the set.

1. Unicast Addresses:

A unicast address identifies a single interface. When a network device sends a packet to a unicast address, the packet goes only to the specific interface identified by that address. Unicast addresses support a global address scope and two types of local address scopes.

A unicast address consists of *n* bits for the prefix, and 128 – *n* bits for the interface ID.

- Global unicast address—A unique IPv6 address assigned to a host interface. These addresses have a global scope and essentially the same purposes as IPv4 public addresses. Global unicast addresses are routable on the Internet.
- Link-local IPv6 address—An IPv6 address that allows communication between neighboring hosts that reside on the same link. Link-local addresses have a local scope, and cannot be used outside the link. They always have the prefix FE80::/10.
- Loopback IPv6 address—An IPv6 address used on a loopback interfaces. The IPv6 loopback address is 0:0:0:0:0:0:0:1, which can be notated as ::1/128.
- Unspecified address—An IPv6 unspecified address is 0:0:0:0:0:0:0:0, which can be notated as ::/128.

1. Aggregatable Global Unicast Addresses:
   Aggregate global unicast addresses are used for global communication. These addresses are similar in function to IPv4 addresses under classless interdomain routing (CIDR). The following table shows their format.

3 bits	45 bits	16 bits	64 bits
001	global routing prefix	subnet ID	interface ID

2. Geographic-Based Addresses:
   Geography addresses are those determined by country of origin. This type of address is only available in the IPv4 address category. The data address table includes a ‘scope’ and a ‘authority‘

Scope	Authority
Multiregional	IANA
Europe	RIPE-NCC
Northern America	INTERNIC
Asia and Pacific	APNIC

3. Link Local Addresses:
   A link-local address is a network address that is valid only for communications within the network segment or the broadcast domain that the host is connected to. Link-local addresses are most often assigned automatically with a process known as stateless address autoconfiguration or link-local address autoconfiguration,[1] also known as automatic private IP addressing (APIPA) or auto-IP.

4. Site Local Addresses:

Site-local addresses are designed to be used for addressing inside of a site without the need for a global prefix. A site-local address cannot be reached from another site. A site-local address is not automatically assigned to a node. It must be assigned using automatic or manual configuration.

5. The Unspecified Address:
   The address 0:0:0:0:0:0:0:0 is called the unspecified address. It will not be assigned to any node. It indicates the absence of an address. One example of its use is in the Source Address field of any IPv6 packets sent by an initializing host before it has learned its own address.

6. The Loopback Address:
   The IP address 127.0.0.1 is called a loopback address. Packets sent to this address never reach the network but are looped through the network interface card only. This can be used for diagnostic purposes to verify that the internal path through the TCP/IP protocols is working.

7. NSAP Addresses:
   Short for Network Service Access Point, NSAP is an address consisting of up to 20 octets that identify a computer or network connected to an ATM network. NSAP is defined in ISO/IEC 8348.

8. IPX Addresses:
   Internetwork Packet Exchange (IPX) is the network layerprotocol in the IPX/SPXprotocol suite. IPX is derived from Xerox Network Systems' IDP. It may act as a transport layer protocol as well.

2. Anycast Address:

An anycast address identifies a set of interfaces that typically belong to different nodes. Anycast addresses are similar to multicast addresses, except that packets are sent only to one interface, not to all interfaces. The routing protocol used in the network usually determines which interface is physically closest within the set of anycast addresses and routes the packet along the shortest path to its destination.

There is no difference between anycast addresses and unicast addresses except for the subnet-router address. For an anycast subnet-router address, the low-order bits, typically 64 or more, are zero. Anycast addresses are taken from the unicast address space.

3. Multicast Addresses:

A multicast address identifies a set of interfaces that typically belong to different nodes. When a network device sends a packet to a multicast address, the device broadcasts the packet to all interfaces identified by that address. IPv6 does not support broadcast addresses, but instead uses multicast addresses in this role.

Multicast addresses support 16 different types of address scope, including node, link, site, organization, and global scope. A 4-bit field in the prefix identifies the address scope.

The following types of multicast addresses can be used in an IPv6 subscriber access network:

- Solicited-node multicast address—Neighbor Solicitation (NS) messages are sent to this address.
- All-nodes multicast address—Router Advertisement (RA) messages are sent to this address.
- All-routers multicast address—Router Solicitation (RS) messages are sent to this address.

➢ **Which addresses are generally used for a node?**

1. Addresses of a Host:

- Its Link Local address for each interface
- Unicast addresses assigned to interfaces
- The loopback address
- All-Nodes multicast address
- Neighbor Discovery multicast addresses associated with all uni-cast and anycast addresses assigned to interfaces
- Multicast Addresses of groups to which the node belongs

2. Addresses of a Router:

- Its Link Local address for each interface
- Unicast addresses assigned to interfaces
- The loopback address
- The Subnet Router anycast address for all links on which it has interfaces
- Other anycast addresses assigned to interfaces
- All-nodes multicast address
- All-routers multicast address
- Neighbor Discovery multicast addresses associated with all uni-cast and anycast addresses assigned to interfaces
- Multicast addresses of groups to which the node belongs

Result :

Hence Study of IPV6 Addressing & Subnetting is completed sucessfully

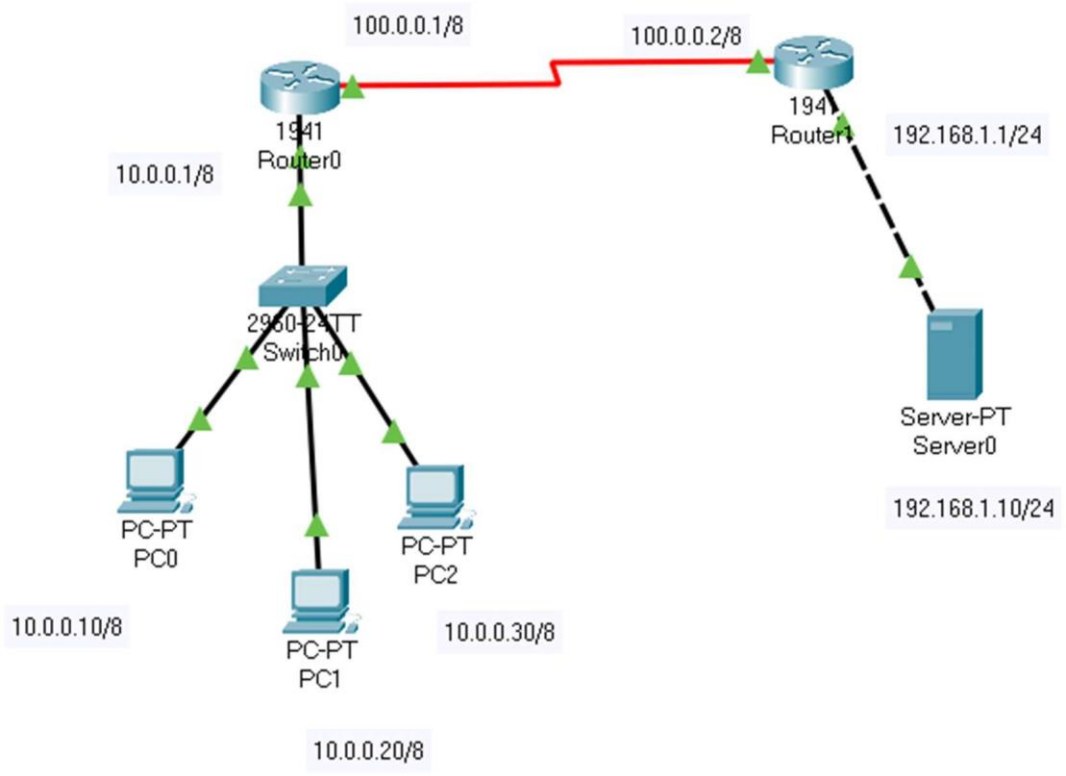
Ex.No:12	IMPLEMENTATION OF NETWORK ADDRESS TRANSLATION
Date:	

Aim:

To study and perform Network Address Translation (NAT) using cisco packet tracer.

Procedure:

1. Assign the following topology with respective IP addresses to pc, routers, servers and connection between them.



2. **Configure static NAT configuration**

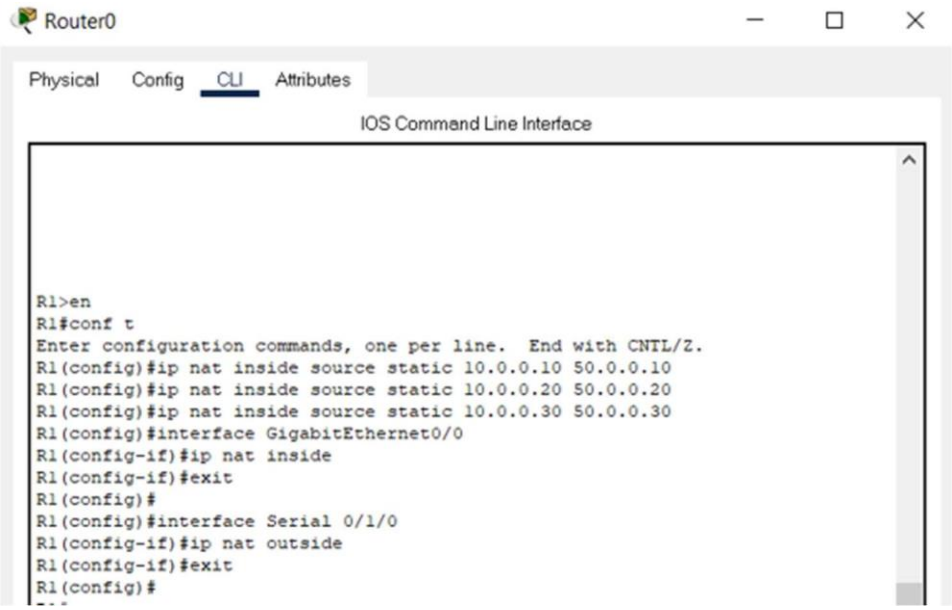
Since static NAT use manual translation, we have to map each inside local IP address (which needs a translation) with inside global IP address. Following command is used to map the inside local IP address with inside global IP address.

```
Router(config)#ip nat inside source static [inside local ip address] [inside global IP address]
```

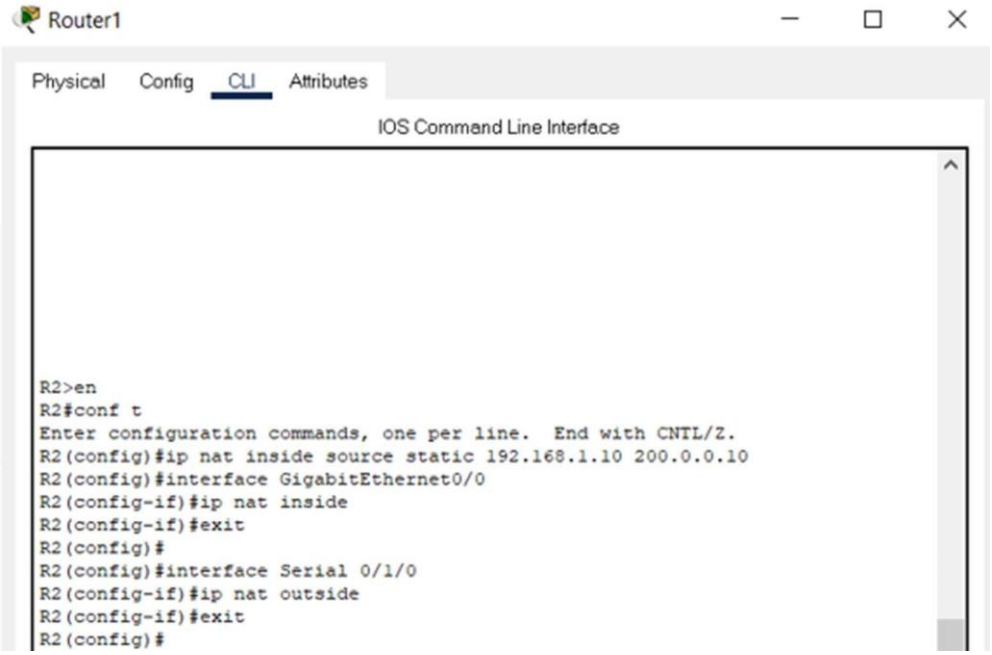
And use the following commands to define inside and outside network connection for your local and global IP addresses.

```
Router(config-if)#ip nat inside
Router(config-if)#ip nat outside
```

Static NAT configuration for Router0 connected with 3 pc's:



Static NAT configuration for Router0 connected with server:



3. Configure the IP routing

IP routing is the process which allows router to route the packet between different networks.

IP routing on router0:

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip route 200.0.0.0 255.255.255.0 100.0.0.2
R1(config)#no shutdown
                ^
```

IP routing on router1:

```
R2(config)#
R2(config)#ip route 50.0.0.0 255.0.0.0 100.0.0.1
```

4. Testing Static NAT Configuration

To test this setup click on any PC and Desktop and click Command Prompt.

- Run ipconfig command.
- Run ping 200.0.0.10 command.
- Run ping 192.168.1.10 command

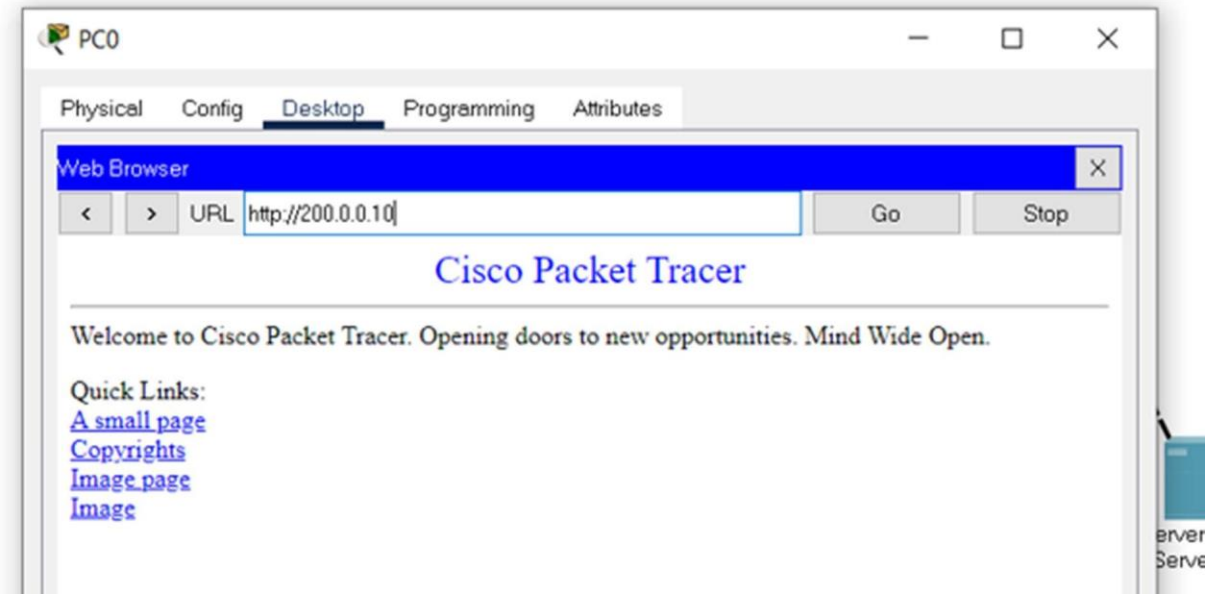
First command verifies that we are testing from correct NAT device.

Second command checks whether we are able to access the remote device or not. A ping reply confirms that we are able to connect with remote device on this IP address.

Third command checks whether we are able to access the remote device on its actual IP address or not. A ping error confirms that we are not able to connect with remote device on this IP address.

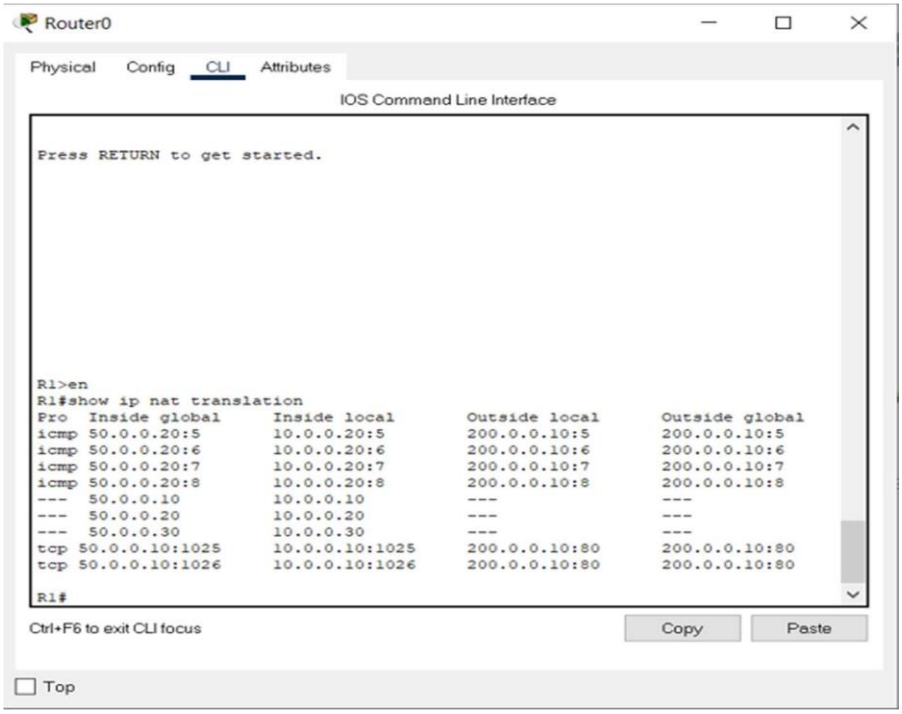

PC0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
Reply from 10.0.0.1: Destination host unreachable.
Ping statistics for 192.168.1.10:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>ipconfig
FastEthernet0 Connection:(default port)
Connection-specific DNS Suffix..:
Link-local IPv6 Address.....: FE80::260:47FF:FE93:623B
IPv6 Address.....: ::
IPv4 Address.....: 10.0.0.10
Subnet Mask.....: 255.0.0.0
Default Gateway.....: ::
10.0.0.1
Bluetooth Connection:
Connection-specific DNS Suffix..:
Link-local IPv6 Address.....: ::
IPv6 Address.....: ::
IPv4 Address.....: 0.0.0.0
Subnet Mask.....: 0.0.0.0
Default Gateway.....: ::
0.0.0.0
C:\>ping 200.0.0.10
Pinging 200.0.0.10 with 32 bytes of data:
Reply from 200.0.0.10: bytes=32 time=10ms TTL=126
Reply from 200.0.0.10: bytes=32 time=1ms TTL=126
Reply from 200.0.0.10: bytes=32 time=2ms TTL=126
Reply from 200.0.0.10: bytes=32 time=8ms TTL=126
Ping statistics for 200.0.0.10:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 10ms, Average = 5ms
C:\>ping 192.168.1.10
Pinging 192.168.1.10 with 32 bytes of data:
Reply from 10.0.0.1: Destination host unreachable.
Reply from 10.0.0.1: Destination host unreachable.
Reply from 10.0.0.1: Destination host unreachable.
Reply from 10.0.0.1: Destination host unreachable.
Ping statistics for 192.168.1.10:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
C:\>
Top

Another way of testing is via browser:



We can also verify this translation on router with ***show ipnat translation*** command.

For router0:



For router1:

```
R2#show ip nat translation
Pro  Inside global     Inside local       Outside local      Outside global
---  200.0.0.10        192.168.1.10       ---                ---
tcp 200.0.0.10:80      192.168.1.10:80    50.0.0.10:1025     50.0.0.10:1025
tcp 200.0.0.10:80      192.168.1.10:80    50.0.0.10:1026     50.0.0.10:1026

R2#
```

Result:

Henceforth, Network Address Translation (NAT) using cisco packet tracer implemented and verified.

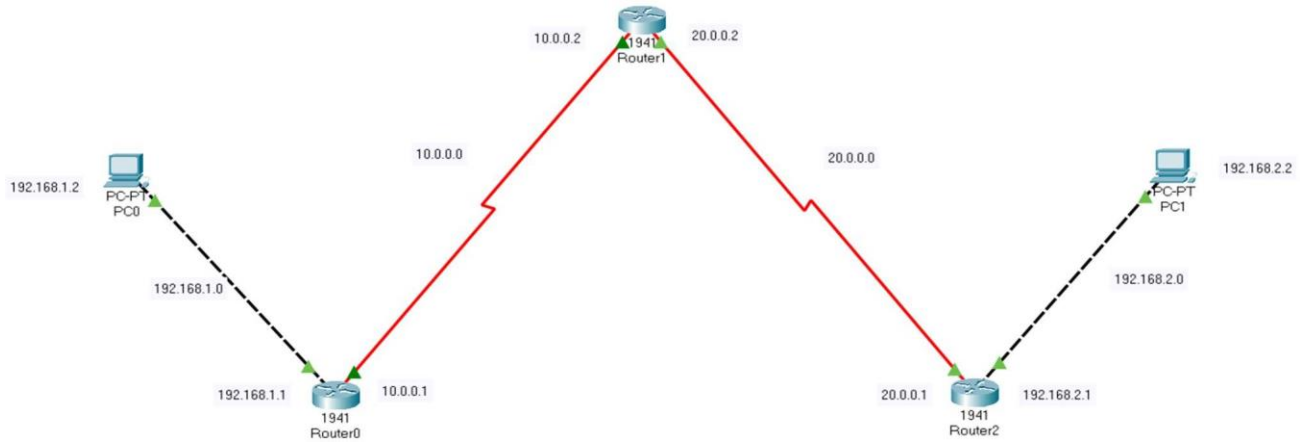
Ex.No:13	IMPLEMENTATION OF VPN
Date:	

AIM :

To configure VPN using routers in Cisco Packet Tracer.

PROCEDURE :

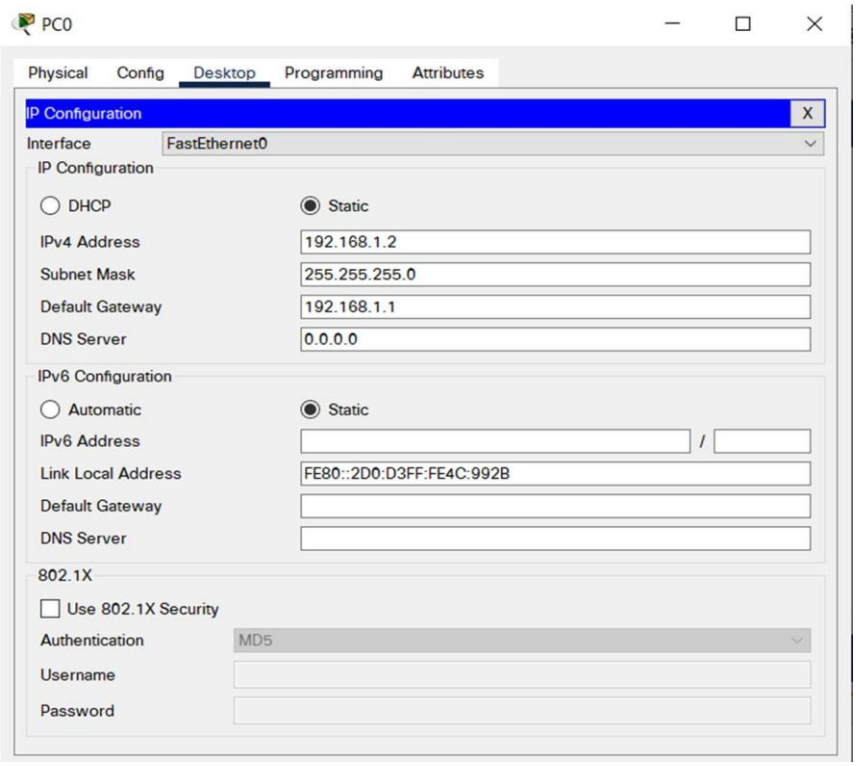
1 . Connect the devices as shown in the below figure.



2 . Initial IP configuration.

Device / Interface	IP Address	Connected with
PC0 / Fa0	192.168.1.2 /24	Router1 / Gig0/0
PC1 / Fa0	192.168.2.2 /24	Router2 / Gig0/0
Router1 / Se0/1/0	10.0.0.1 /8	Router 2 / Se0/1/0
Router2 / Se0/1/0	10.0.0.2 /8	Router 1 / Se0/1/0
Router2 / Se0/1/1	20.0.0.1 /8	Router3 / Se0/1/0
Router3 / Se0/1/0	20.0.0.2 /8	Router2 / Se0/1/1

3 .To assign IP address in Laptop click Laptop and click Desktop and IP configuration and Select Static and set IP address as given in above table.



Following the same way, configure the IP address in PC1.

4. We have to assign ip address on each and every interface of router

CONFIGURATION ON ROUTER1:

```
Router>enable

Router#config t

Router(config)#int gig0/0

Router(config-if)#ip add 192.168.1.1 255.255.255.0

Router(config-if)#no shut

Router(config-if)#exit

Router(config)#int se0/1/0

Router(config-if)#ip address 10.0.0.1 255.0.0.0

Router(config-if)#no shut
```

CONFIGURATION ON ROUTER2:

```
Router>enable
Router#config t
Router(config)#int se0/1/0
Router(config-if)#ip add 10.0.0.2 255.0.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#int se0/1/1
Router(config-if)#ip add 20.0.0.1 255.0.0.0
Router(config-if)#no shut
```

CONFIGURATION ON ROUTER3:

```
Router>enable
Router#config t
Router(config)#int se0/1/0
Router(config-if)#ip add 20.0.0.2 255.0.0.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#int gig0/0
Router(config-if)#ip add 192.168.2.1 255.255.255.0
Router(config-if)#no shut
```

5. Now it's time to do routing. Here we have to configure default routing.

DEFAULT ROUTING CONFIGURATION ON ROUTER1:

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 0.0.0.0 0.0.0.0 10.0.0.2
Router(config)#
```

DEFAULT ROUTING CONFIGURATION ON ROUTER3:

```
Router>enable
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 0.0.0.0 0.0.0.0 20.0.0.1
Router(config)#
```

6. NOW CHECK THE CONNECTION BY PINGING EACH OTHER.

First we go to Router1 and ping with Router3:

```
Router#ping 20.0.0.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 20.0.0.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 26/28/33 ms
```

Now we go to Router3 and test the network by pinging Router1 interface.

```
Router#ping 10.0.0.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.0.0.1, timeout is 2 seconds:
!!!!!
```

```
Success rate is 100 percent (5/5), round-trip min/avg/max = 25/28/32 ms
```

You can clearly see both routers pinging each other successfully.

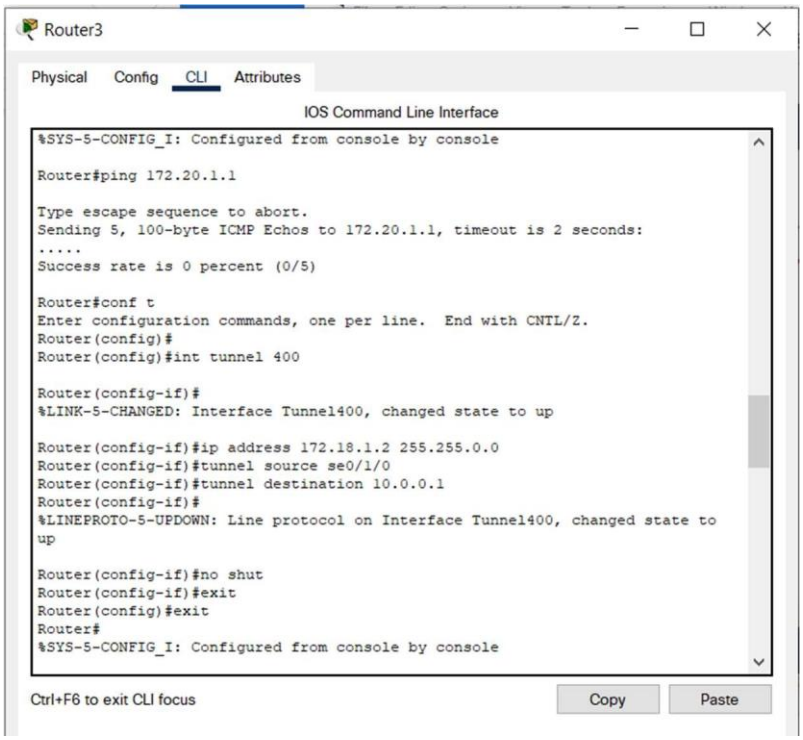
7. NOW CREATE VPN TUNNEL between Router1 and Router3:

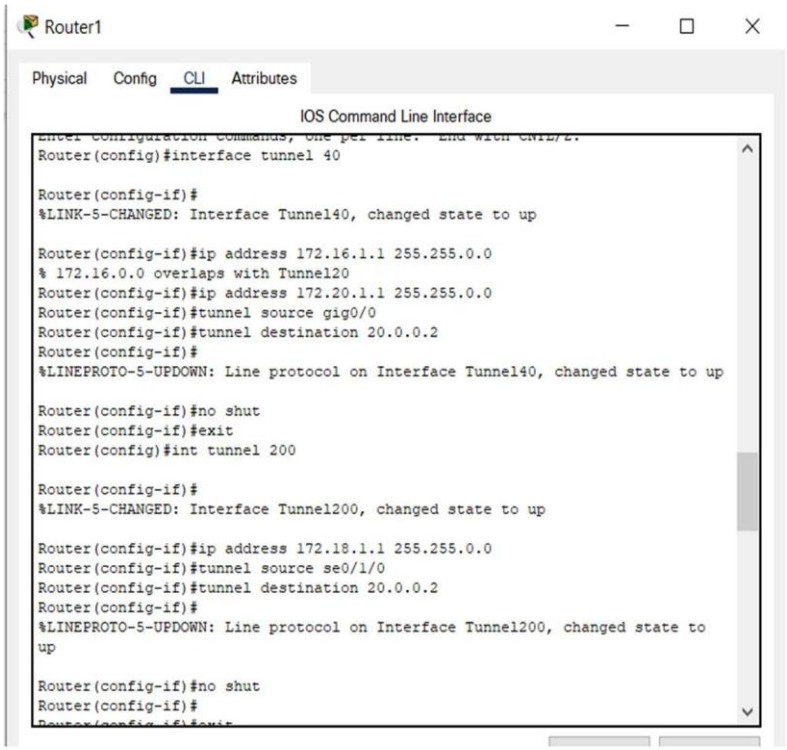
FIRST CREATE A VPN TUNNEL ON ROUTER1:

```
Router#config t
Router(config)#interface tunnel 200
Router(config-if)#ip address 172.18.1.1 255.255.0.0
Router(config-if)#tunnel source se0/1/0
Router(config-if)#tunnel destination 20.0.0.2
Router(config-if)#no shut
```

NOW CREATE A VPN TUNNEL ON ROUTER R3:

```
Router#config t
Router(config)#interface tunnel 400
Router(config-if)#ip address 172.18.1.2 255.255.0.0
Router(config-if)#tunnel source se0/1/0
Router(config-if)#tunnel destination 10.0.0.1
Router(config-if)#no shut
```


Router3
Physical
Config
CLI
Attributes
IOS Command Line Interface
%SYS-5-CONFIG_I: Configured from console by console
Router#ping 172.20.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.20.1.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)#int tunnel 400
Router(config-if)#
%LINK-5-CHANGED: Interface Tunnel400, changed state to up
Router(config-if)#ip address 172.18.1.2 255.255.0.0
Router(config-if)#tunnel source se0/1/0
Router(config-if)#tunnel destination 10.0.0.1
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel400, changed state to up
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
Ctrl+F6 to exit CLI focus
Copy
Paste


Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router(config)#interface tunnel 40
Router(config-if)#
%LINK-5-CHANGED: Interface Tunnel40, changed state to up
Router(config-if)#ip address 172.16.1.1 255.255.0.0
% 172.16.0.0 overlaps with Tunnel20
Router(config-if)#ip address 172.20.1.1 255.255.0.0
Router(config-if)#tunnel source gig0/0
Router(config-if)#tunnel destination 20.0.0.2
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel40, changed state to up
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#int tunnel 200
Router(config-if)#
%LINK-5-CHANGED: Interface Tunnel200, changed state to up
Router(config-if)#ip address 172.18.1.1 255.255.0.0
Router(config-if)#tunnel source se0/1/0
Router(config-if)#tunnel destination 20.0.0.2
Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel200, changed state to up
Router(config-if)#no shut
Router(config-if)#

8. Now test communication between these two routers again by pinging each other:

Router1

```
Router#ping 172.18.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.18.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 30/32/36 ms

Router#
```

Router2

```
Router#ping 172.18.1.1

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 172.18.1.1, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 33/45/83 ms
```

9. Now do routing for created VPN Tunnel on Both Router1 and Router3:

```
Router(config)#ip route 192.168.2.0 255.255.255.0 172.18.1.2

Router(config)#ip route 192.168.1.0 255.255.255.0 172.18.1.1
```

10. TEST VPN TUNNEL CONFIGURATION:

Now we have to test whether tunnel is created or not for Router1

```
Router#show interfaces Tunnel 200

Tunnel200 is up, line protocol is up (connected)

Hardware is Tunnel

Internet address is 172.18.1.1/16
```

MTU 17916 bytes, BW 100 Kbit/sec, DLY 50000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation TUNNEL, loopback not set

Keepalive not set

Tunnel source 10.0.0.1 (FastEthernet0/1), destination 20.0.0.2

Tunnel protocol/transport GRE/IP

Key disabled, sequencing disabled

Checksumming of packets disabled

Tunnel TTL 255

Fast tunneling enabled

Tunnel transport MTU 1476 bytes

Tunnel transmit bandwidth 8000 (kbps)

Tunnel receive bandwidth 8000 (kbps)

Last input never, output never, output hang never

Last clearing of "show interface" counters never

Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 1

Queueing strategy: fifo

Output queue: 0/0 (size/max)

5 minute input rate 32 bits/sec, 0 packets/sec

5 minute output rate 32 bits/sec, 0 packets/sec

52 packets input, 3508 bytes, 0 no buffer

Received 0 broadcasts, 0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

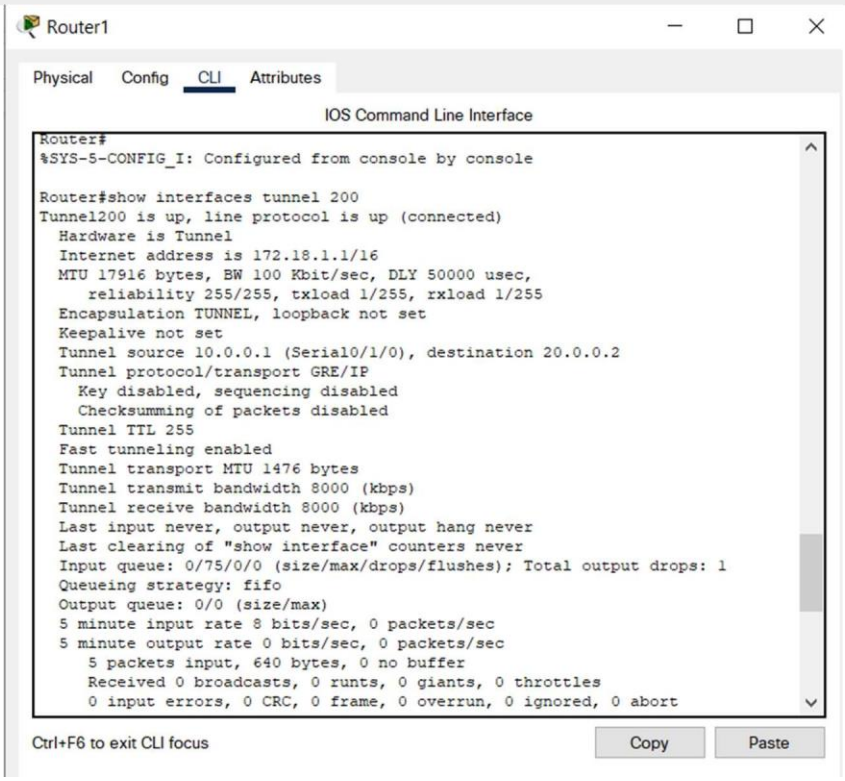
0 input packets with dribble condition detected

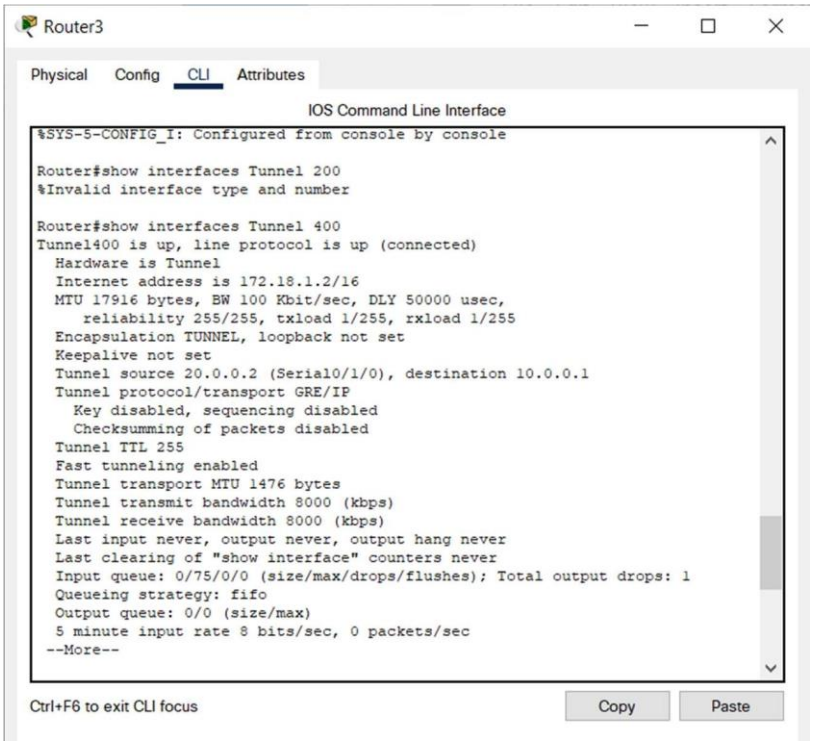
52 packets output, 3424 bytes, 0 underruns

0 output errors, 0 collisions, 0 interface resets

0 unknown protocol drops

0 output buffer failures, 0 output buffers swapped out





Now going to Router3 and test VPN Tunnel Creation:

```
Router #show interface Tunnel 400
Tunnel400 is up, line protocol is up (connected)
Hardware is Tunnel
Internet address is 172.18.1.2/16
MTU 17916 bytes, BW 100 Kbit/sec, DLY 50000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation TUNNEL, loopback not set
Keepalive not set
Tunnel source 20.0.0.2 (FastEthernet0/0), destination 10.0.0.1
Tunnel protocol/transport GRE/IP
Key disabled, sequencing disabled
Checksumming of packets disabled
Tunnel TTL 255
Fast tunneling enabled
Tunnel transport MTU 1476 bytes
Tunnel transmit bandwidth 8000 (kbps)
Tunnel receive bandwidth 8000 (kbps)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 1
Queueing strategy: fifo


Output queue: 0/0 (size/max)
5 minute input rate 32 bits/sec, 0 packets/sec
```

5 minute output rate 32 bits/sec, 0 packets/sec

52 packets input, 3424 bytes, 0 no buffer

Received 0 broadcasts, 0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort

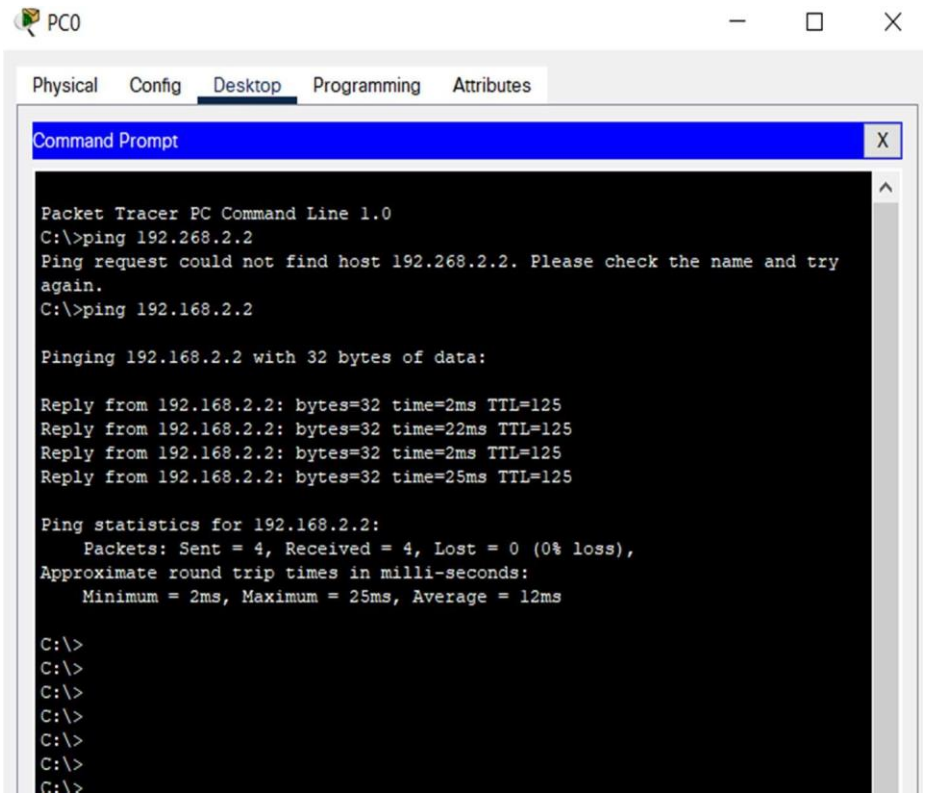
0 input packets with dribble condition detected

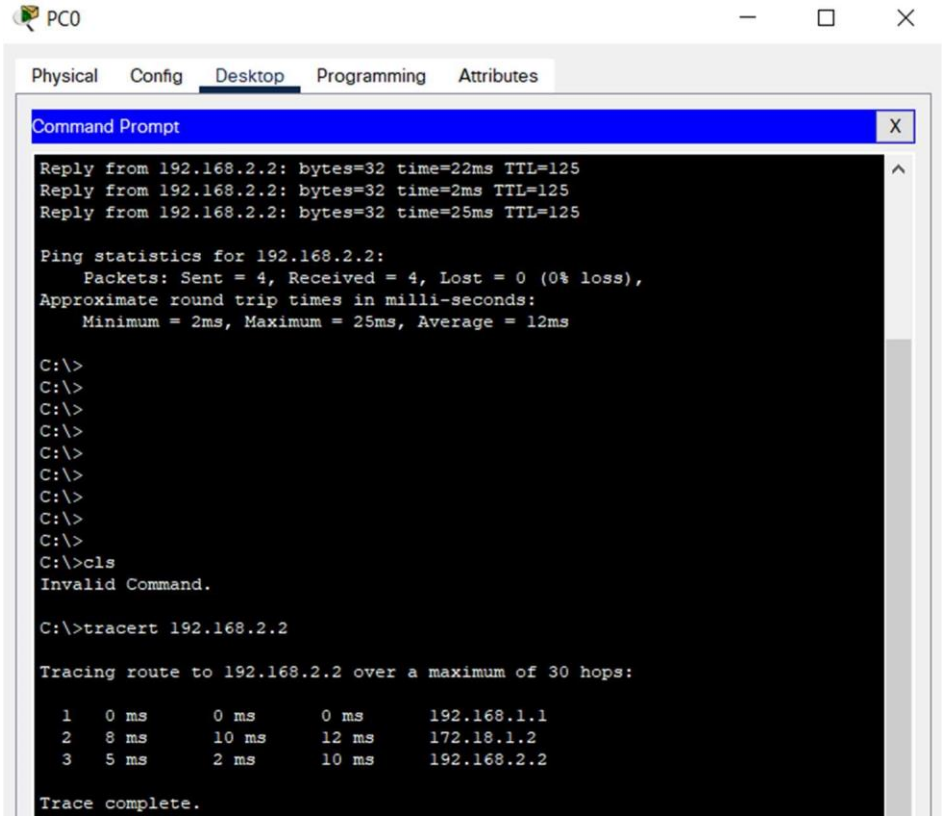
53 packets output, 3536 bytes, 0 underruns

0 output errors, 0 collisions, 0 interface resets

0 unknown protocol drops

11. Trace the VPN tunnel path.





RESULT:

Hence successfully, configured VPN using routers in Cisco Packet Tracer.

Ex.No:14	COMMUNICATION USING HDLC
Date:	

AIM:

To configure HDLC Protocol using routers in Cisco Packet Tracer.

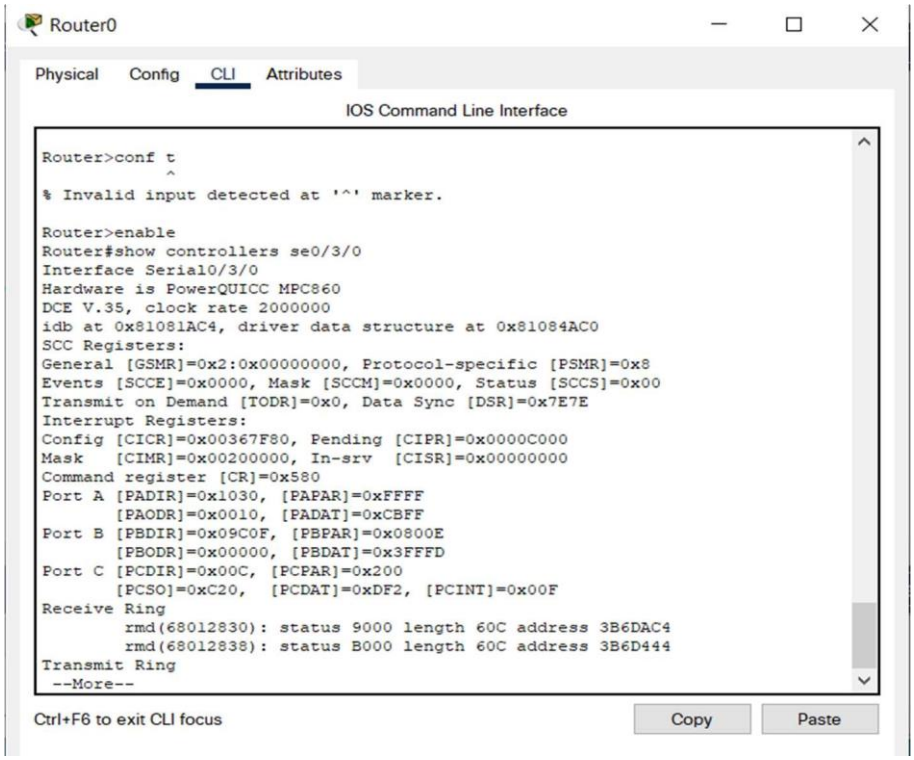
PROCEDURE:

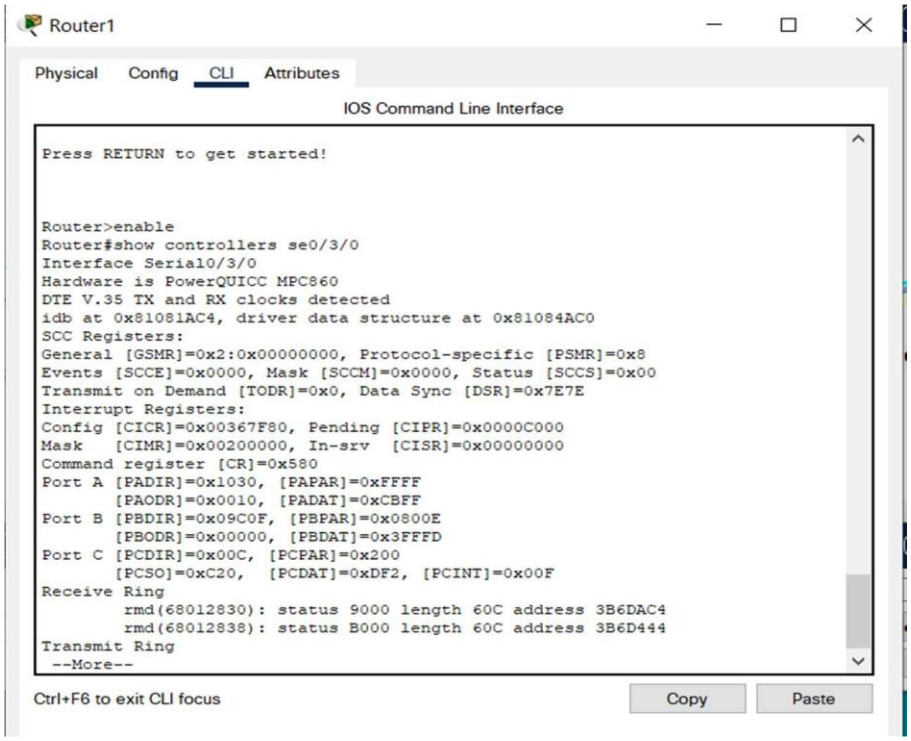
1. Connect the devices as shown in the below figure.

2 . Initial IP configuration.

Device / Interface	IP Address	Connected with
PC0 / Fa0	10.0.0.2 /8	Router0 / Fa0/0
PC1 / Fa0	20.0.0.2 /8	Router1 / Fa0/0
Router0 / Se0/3/0	192.168.1.2 /30	Router1 / Se0/3/0
Router1 / Se0/3/0	192.168.1.3 /30	Router0 / Se0/3/0

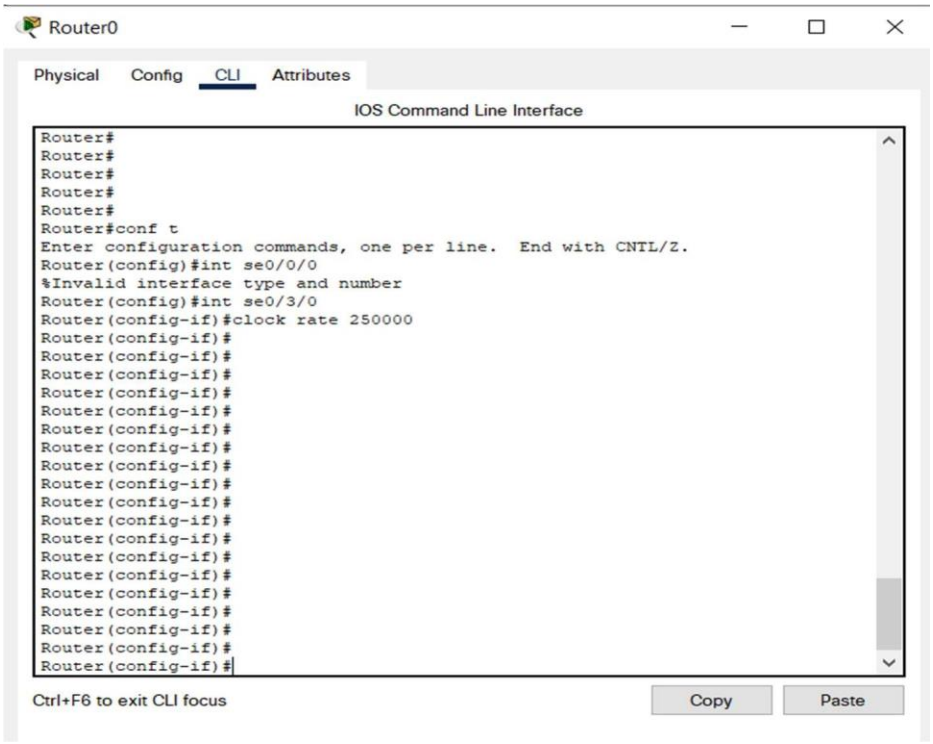
3 . Use the connected laptops to find the DCE and DTE routers



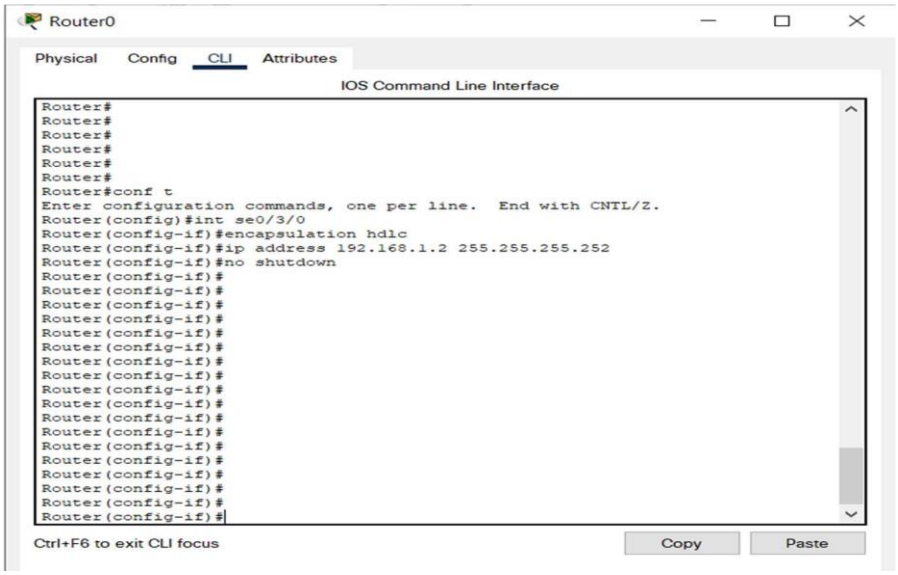


4. Configure the routers with the following parameters

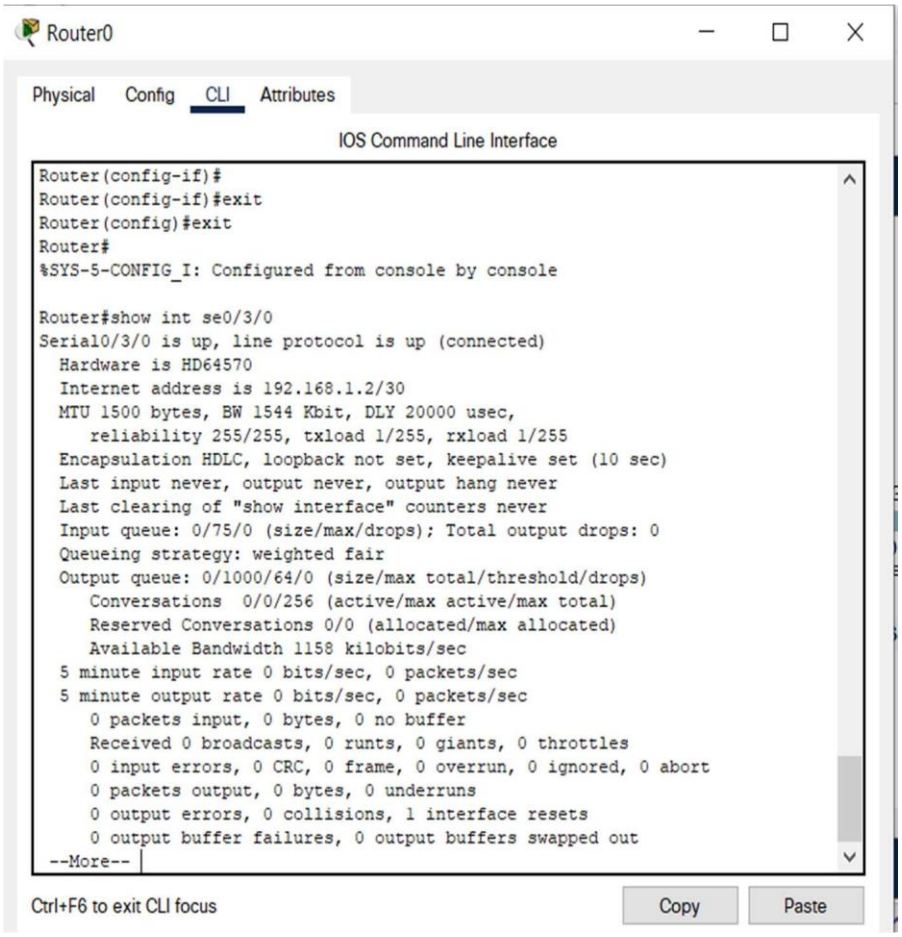
Router0 being the DCE, clock rate has to be configured on Router0 serial 0/3/0 interface.



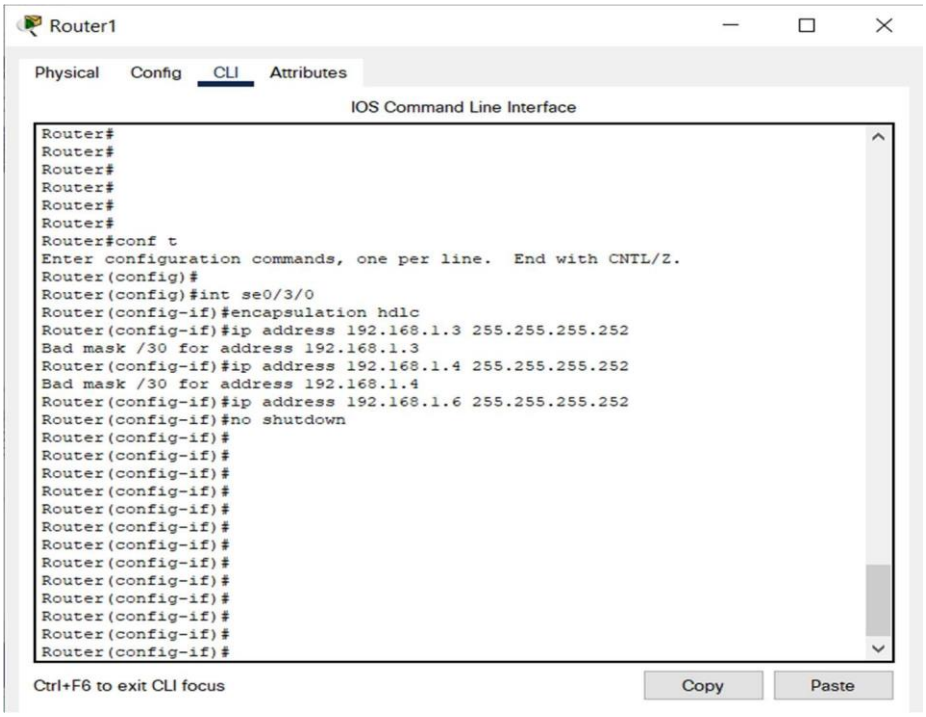
5. Then, configure HDLC encapsulation and IP address on Router0 serial 0/3/0 interface. The **encapsulation hdlc** configures HDLC protocol on the serial interface. Router0 being the DCE side of the serial link, the 192.168.1.3 /30 IP address is configured on Router0 serial 0/3/0 interface. Don't forget to enable the interface with a no shutdown command.



6. The show interfaces serial 0/3/0 confirms that HDLC encapsulation is enabled on the interface : Encapsulation HDLC, loopback not set, keepalive set (10 sec)



7. Finally, configure HDLC encapsulation and IP address on Router1 serial 0/3/0 interface. The link comes up as both routers are correctly configured.



8. NOW CHECK THE CONNECTION BY PINGING EACH OTHER.

First we go to Router0 and ping with Router1:

Router#ping 192.168.1.6

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 198.168.1.6, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 26/28/33 ms

Now we go to Router1 and test the network by pinging the Router0 interface.

Router#ping 192.168.1.2

Type escape sequence to abort.

Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:

!!!!!

Success rate is 100 percent (5/5), round-trip min/avg/max = 25/28/32 ms

RESULT :

Hence successfully, configured HDLC Protocol using routers in Cisco Packet Tracer.

Ex.No:15	COMMUNICATION USING HDLC
Date:	

AIM:

To configure PPP using routers in Cisco Packet Tracer.

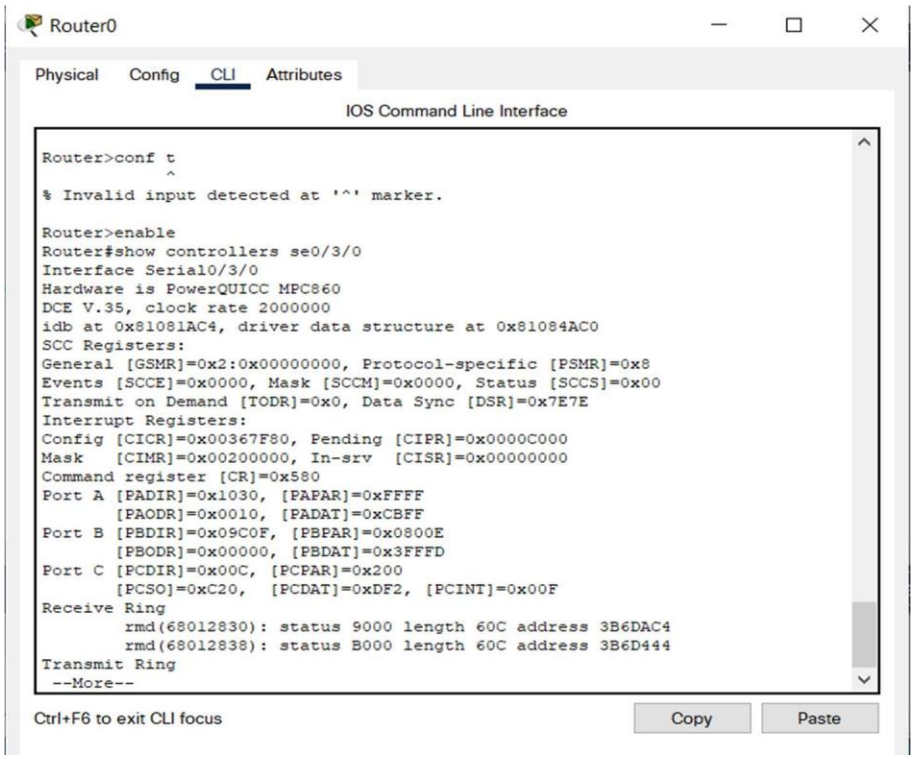
PROCEDURE:

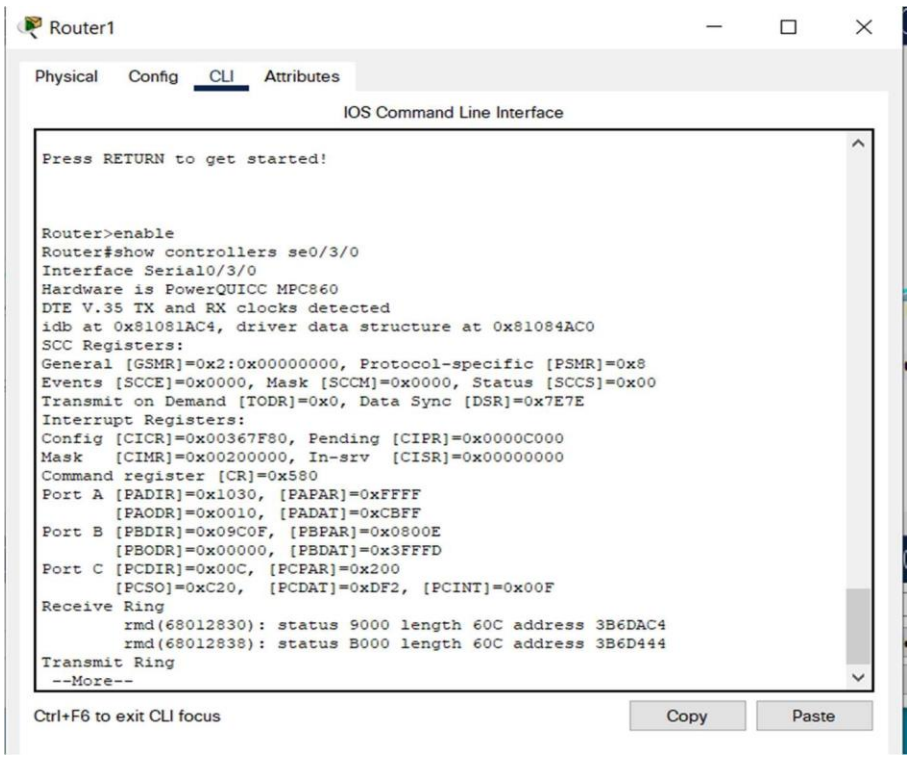
1 . Connect the devices as shown in the below figure.

2 . Initial IP configuration.

Device / Interface	IP Address	Connected with
PC0 / Fa0	10.0.0.2 /8	Router0 / Fa0/0
PC1 / Fa0	20.0.0.2 /8	Router1 / Fa0/0
Router0 / Se0/3/0	192.168.1.2 /30	Router1 / Se0/3/0
Router1 / Se0/3/0	192.168.1.3 /30	Router0 / Se0/3/0

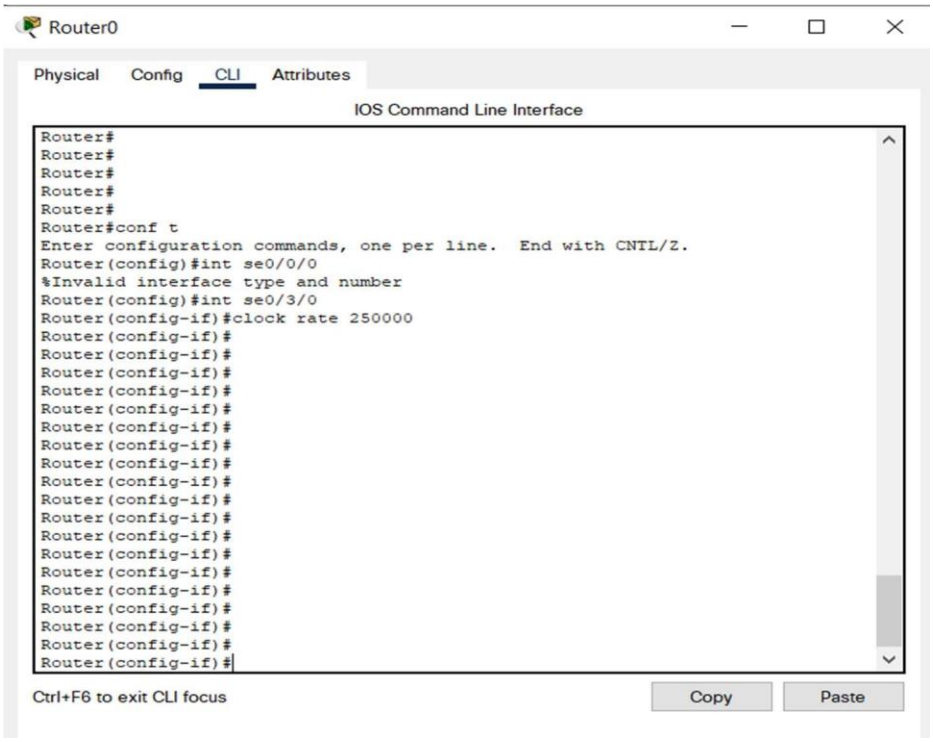
3 . Use the connected laptops to find the DCE and DTE routers


Router0
Physical
Config
CLI
Attributes
IOS Command Line Interface
Router>conf t
^
% Invalid input detected at '^' marker.
Router>enable
Router#show controllers se0/3/0
Interface Serial0/3/0
Hardware is PowerQUICC MPC860
DCE V.35, clock rate 2000000
idb at 0x81081AC4, driver data structure at 0x81084AC0
SCC Registers:
General [GSMR]=0x2:0x00000000, Protocol-specific [PSMR]=0x8
Events [SCCE]=0x0000, Mask [SCCM]=0x0000, Status [SCCS]=0x00
Transmit on Demand [TODR]=0x0, Data Sync [DSR]=0x7E7E
Interrupt Registers:
Config [CICR]=0x00367F80, Pending [CIPR]=0x0000C000
Mask [CIMR]=0x00200000, In-srv [CISR]=0x00000000
Command register [CR]=0x580
Port A [PADIR]=0x1030, [PAPAR]=0xFFFF
[PAODR]=0x0010, [PADAT]=0xCBFF
Port B [PBDIR]=0x09C0F, [PBPAR]=0x0800E
[PBODR]=0x00000, [PBDAT]=0x3FFFD
Port C [PCDIR]=0x00C, [PCPAR]=0x200
[PCSO]=0xC20, [PCDAT]=0xDF2, [PCINT]=0x00F
Receive Ring
rmd(68012830): status 9000 length 60C address 3B6DAC4
rmd(68012838): status B000 length 60C address 3B6D444
Transmit Ring
--More--
Ctrl+F6 to exit CLI focus
Copy
Paste

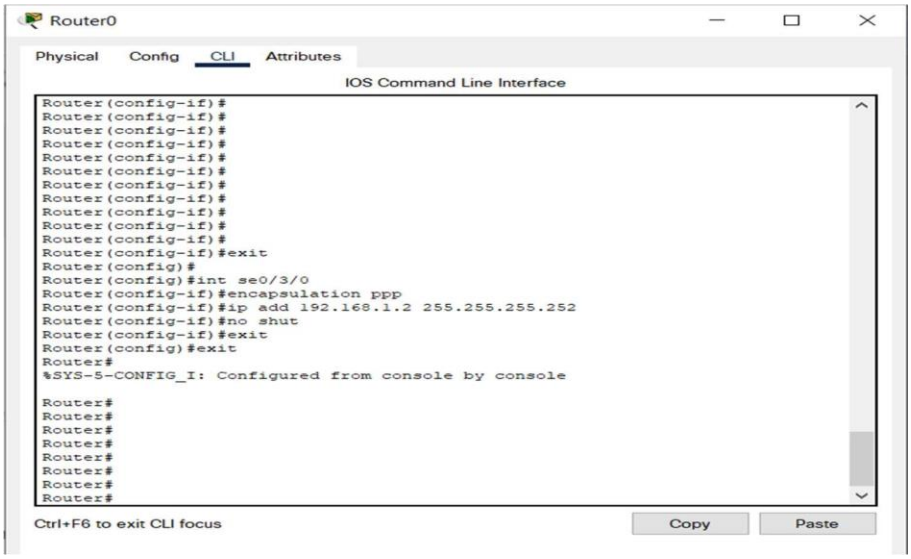

Router1
Physical
Config
CLI
Attributes
IOS Command Line Interface
Press RETURN to get started!
Router>enable
Router#show controllers se0/3/0
Interface Serial0/3/0
Hardware is PowerQUICC MPC860
DTE V.35 TX and RX clocks detected
idb at 0x81081AC4, driver data structure at 0x81084AC0
SCC Registers:
General [GSMR]=0x2:0x00000000, Protocol-specific [PSMR]=0x8
Events [SCCE]=0x0000, Mask [SCCM]=0x0000, Status [SCCS]=0x00
Transmit on Demand [TODR]=0x0, Data Sync [DSR]=0x7E7E
Interrupt Registers:
Config [CICR]=0x00367F80, Pending [CIPR]=0x0000C000
Mask [CIMR]=0x00200000, In-srv [CISR]=0x00000000
Command register [CR]=0x580
Port A [PADIR]=0x1030, [PAPAR]=0xFFFF
[PAODR]=0x0010, [PADAT]=0xCBFF
Port B [PBDIR]=0x09C0F, [PBPAR]=0x0800E
[PBODR]=0x00000, [PBDAT]=0x3FFFD
Port C [PCDIR]=0x00C, [PCPAR]=0x200
[PCSO]=0xC20, [PCDAT]=0xDF2, [PCINT]=0x00F
Receive Ring
rmd(68012830): status 9000 length 60C address 3B6DAC4
rmd(68012838): status B000 length 60C address 3B6D444
Transmit Ring
--More--
Ctrl+F6 to exit CLI focus
Copy
Paste

4. Configure the routers with the following parameters

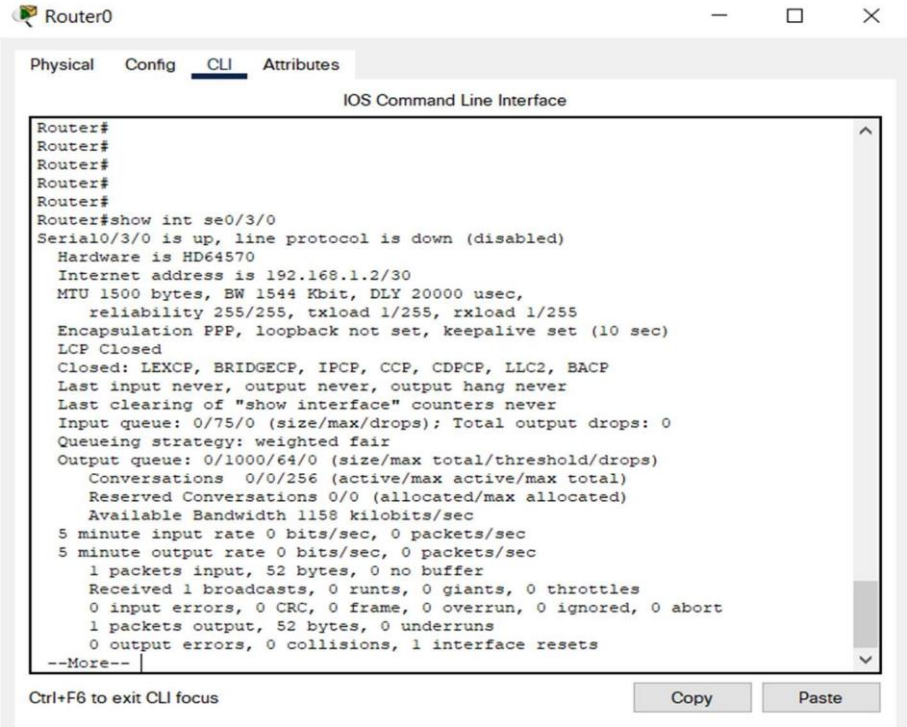
Router0 being the DCE, clock rate has to be configured on Router0 serial 0/3/0 interface.



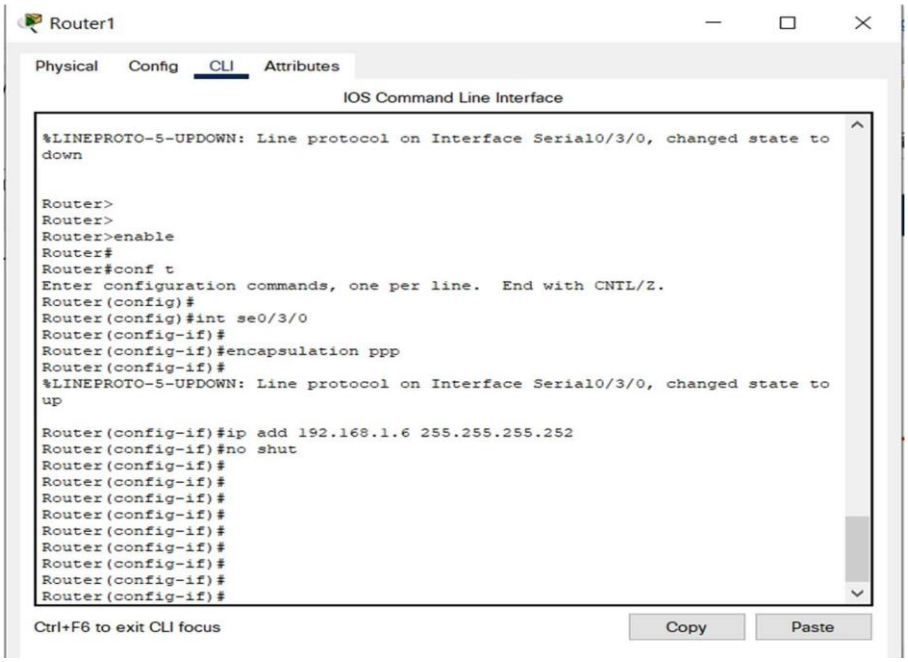
5. Then, configure PPP encapsulation and IP address on Router0 serial 0/3/0 interface. The **encapsulation ppp** configures PPP protocol on the serial interface. Router0 being the DCE side of the serial link, the 192.168.1.3 /30 IP address is configured on Router0 serial 0/3/0 interface. Don't forget to enable the interface with a no shutdown command.



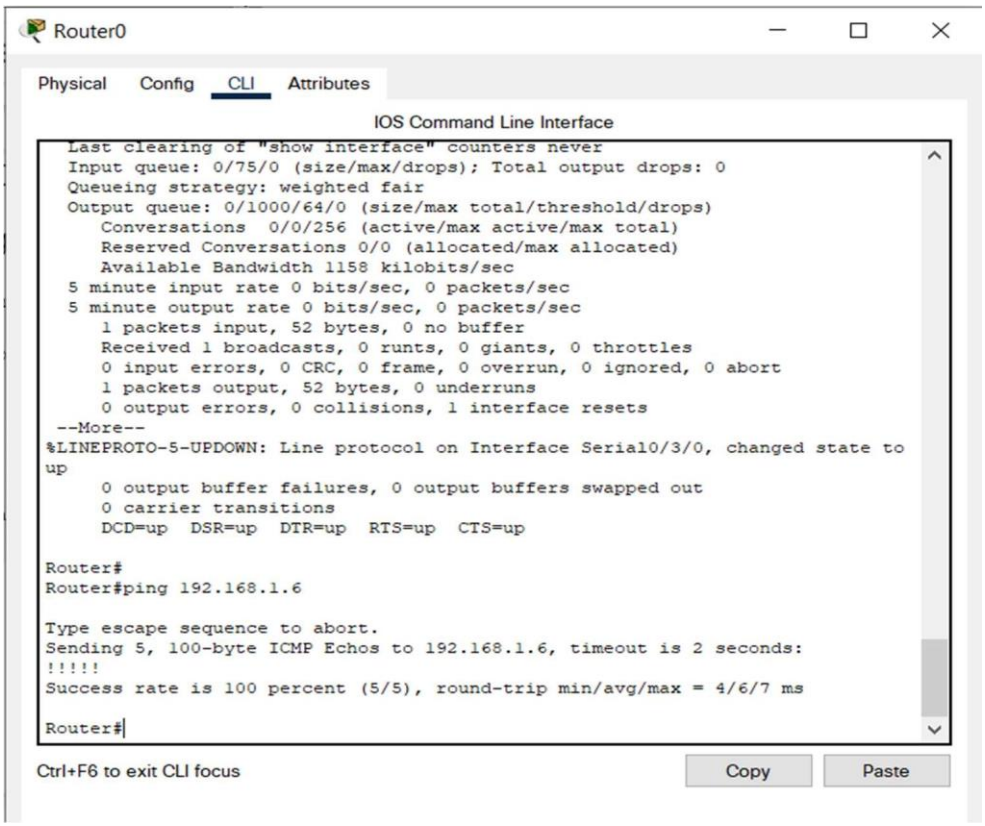
6. The show interfaces serial 0/3/0 confirms that PPP encapsulation is enabled on the interface : Encapsulation PPP, loopback not set, keepalive set (10 sec)



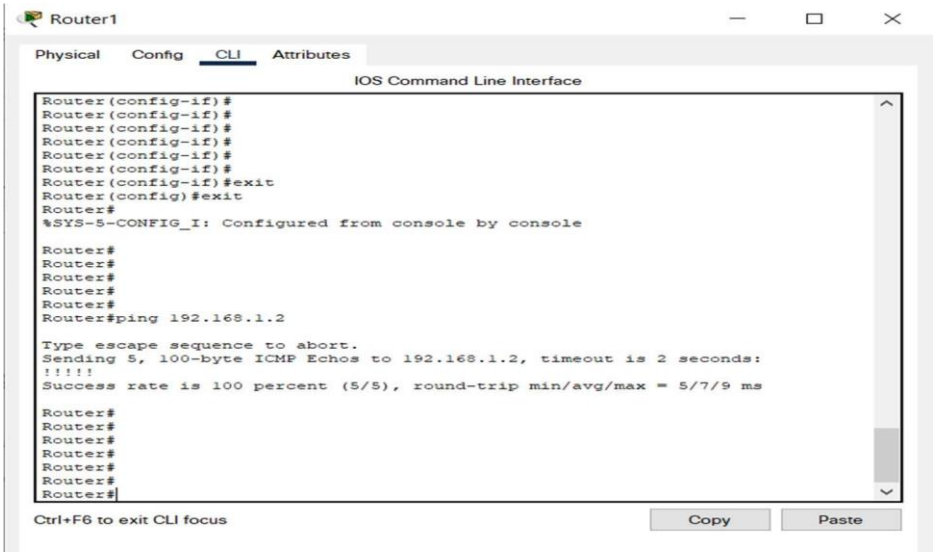
7. Finally, configure PPP encapsulation and IP address on Router1 serial 0/3/0 interface. The link comes up as both routers are correctly configured.



8. NOW CHECK THE CONNECTION BY PINGING EACH OTHER.First we go to Router0 and ping with Router1:



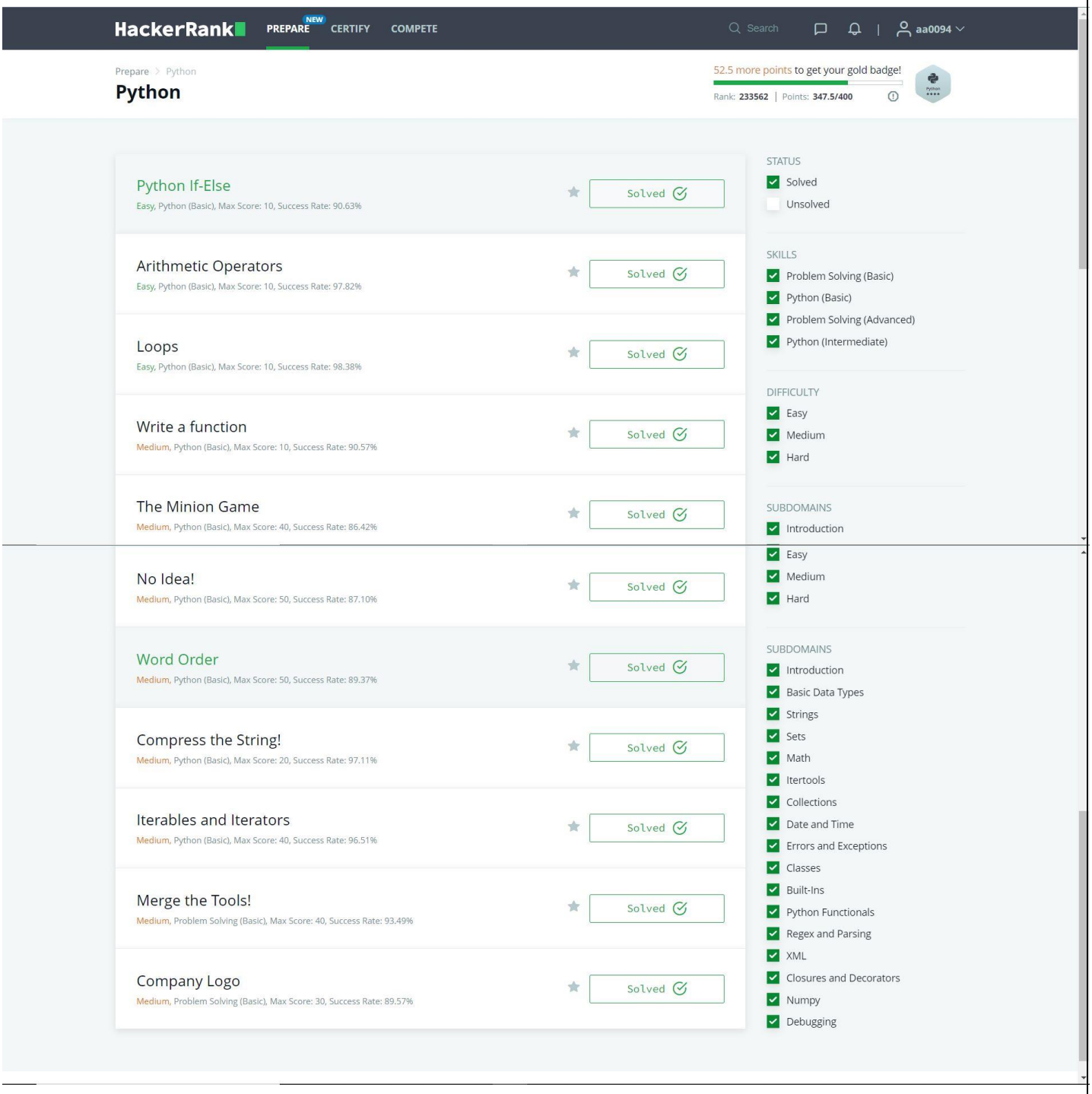
Now we go to Router1 and test the network by pinging the Router0 interface.



RESULT:

Hence successfully, configured PPP using routers in Cisco Packet Tracer.

Hackerrank Solved Questions


HackerRank
PREPARE
NEW
CERTIFY
COMPETE
Search
aa0094
Prepare > Python
Python
52.5 more points to get your gold badge!
Rank: 233562 | Points: 347.5/400
Python If-Else
Easy, Python (Basic), Max Score: 10, Success Rate: 90.63%
Solved
Arithmetic Operators
Easy, Python (Basic), Max Score: 10, Success Rate: 97.82%
Solved
Loops
Easy, Python (Basic), Max Score: 10, Success Rate: 98.38%
Solved
Write a function
Medium, Python (Basic), Max Score: 10, Success Rate: 90.57%
Solved
The Minion Game
Medium, Python (Basic), Max Score: 40, Success Rate: 86.42%
Solved
No Idea!
Medium, Python (Basic), Max Score: 50, Success Rate: 87.10%
Solved
Word Order
Medium, Python (Basic), Max Score: 50, Success Rate: 89.37%
Solved
Compress the String!
Medium, Python (Basic), Max Score: 20, Success Rate: 97.11%
Solved
Iterables and Iterators
Medium, Python (Basic), Max Score: 40, Success Rate: 96.51%
Solved
Merge the Tools!
Medium, Problem Solving (Basic), Max Score: 40, Success Rate: 93.49%
Solved
Company Logo
Medium, Problem Solving (Basic), Max Score: 30, Success Rate: 89.57%
Solved
STATUS
Solved
Unsolved
SKILLS
Problem Solving (Basic)
Python (Basic)
Problem Solving (Advanced)
Python (Intermediate)
DIFFICULTY
Easy
Medium
Hard
SUBDOMAINS
Introduction
Easy
Medium
Hard
SUBDOMAINS
Introduction
Basic Data Types
Strings
Sets
Math
Itertools
Collections
Date and Time
Errors and Exceptions
Classes
Built-Ins
Python Functionals
Regex and Parsing
XML
Closures and Decorators
Numpy
Debugging

ID: A60E5F1CAD04

HackerRank

Certificate

This is to certify that

ANAS AHMED ATHER

has successfully cleared the assessment for the skill

Python (Basic)

15 Nov, 2022

Date

Harishankaran K

CTO, HackerRank

AWS Certification and Badge


aws
ACADEMY
Cloud Security
Foundations

Minor Project

AMEY ONLINE CHESS GAME

A COURSE PROJECT REPORT

By

Mohammad Basheeruddin (RA2011031010001)
Anas Ahmed Ather (RA2011031010006)
Prithivi Singh Kirar(RA2011031010023)
Vanshaj Bhradwaj (RA2011031010026)

Under the guidance of
Ms.S.Thenmalar
In partial fulfilment for the Course
of

18CSC302J - COMPUTER NETWORKS

in Computer Science Engineering Specialization in IT

FACULTY OF ENGINEERING AND TECHNOLOGY SRM INSTITUTE OF SCIENCE AND TECHNOLOGY
Kattankulathur, Chenpalpattu District

NOVEMBER 2022

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Under Section 3 of UGC Act, 1956)

BONAFIDE CERTIFICATE

Certified that this mini project report "**Online Chess Game**" is the bonafide work of **Mohammad Basheeruddin (RA2011031010001), Anas Ahmed Ather (RA2011031010006), Prithivi Singh Kirar(RA2011031010023), Vanshaj Bhradwaj (RA2011031010026)** who carried out the project work under my supervision.

SIGNATURE

Ms.S.Thenmalar
Professor
NWC
SRM Institute of Science and Technology

1. ABSTRACT

We proposed to build an online chess game for single-player as well as multiplayer in nodejs and deploy it on Heroku. An online chess game is developed in compliance with Human-Machine Interaction principles. The web app has a simple and attractive design. The theme of the game can also be customised by the player. The chessboard's background may be changed to suit the user's preferences. Users can play against other players in multiplayer mode, which features a chatbox for real-time conversation between players. Aside from that, chosen blocks will be highlighted for easier sight, and a sound will be heard after each move to confirm the move. While playing, the user learns about the potential movement of the pieces. The browser will notify you if an opponent leaves the game in the middle of a round in multiple player mode.

ACKNOWLEDGEMENT

We express our heartfelt thanks to our honorable **Vice Chancellor Dr. C. MUTHAMIZHCHELVAN**, for being the beacon in all our endeavors.

We would like to express my warmth of gratitude to our **Registrar Dr. S. Ponnusamy,** for his encouragement

We express our profound gratitude to our **Dean (College of Engineering and Technology) Dr. T. V.Gopal,** for bringing out novelty in all executions.

We would like to express my heartfelt thanks to Chairperson, School of Computing **Dr. Revathi Venkataraman,** for imparting confidence to complete my course project

We wish to express my sincere thanks to **Course Audit Professor Dr.Annapurani Panaiyappan, Professor and Head, Department of Networking and Communications** and **Course Coordinators** for their constant encouragement and support.

We are highly thankful to our my Course project Faculty **Ms.S.Thenmalar, professor , NWC,** for his/her assistance, timely suggestion and guidance throughout the duration of this course project.

We extend my gratitude to our HoD **Annapurani Panaiyappan .K Professor & HOD, NWC** and my Departmental colleagues for their Support.

Finally, we thank our parents and friends near and dear ones who directly and indirectly contributed to the successful completion of our project. Above all, I thank the almighty for showering his blessings on me to complete my Course project.

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3.	REQUIREMENT ANALYSIS
4.	IMPLEMENTATION
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	5.1. RESULTS
	5.2. RESULT ANALYSIS
6.	CONCLUSION & FUTURE ENHANCEMENT
7.	REFERENCE

2. INTRODUCTION

2.1 Aim of the project

The project “Online Chess Game” implements a classic version of Chess with a Graphical User Interface (GUI). The Chess game follows the basic rules of chess, and all the chess pieces only move according to valid moves for that piece. It is played on an 8x8 checkerboard, with a dark square in each player's lower-left corner. The website was developed using Nodejs and deployed on Heroku. This is an online chess game that users from remote locations can play and discuss on the website through the chat window. The user can play in single mode and multiplayer mode as well. There is also an option to change the layout of the chessboard as the player would like. While playing, the player gets to know about his current position and the other position in which he can move his pieces.

2.2 What is a chess game

Chess is a game for 2 players each of whom moves 16 pieces according to fixed rules across a checkerboard and tries to checkmate the opponent's king. Our project implements the chess game with a graphical user interface. The chess game follows the basic rules of chess and all the chess pieces only move according to valid moves for that piece.

2.3 What Are The Chess Pieces

The chess pieces are what you move on a chessboard when playing a game of chess. There are six different types of chess pieces. Each side starts with 16 pieces: eight pawns, two bishops, two knights, two rooks, one queen, and one king.

The Pawn

When a game begins, each side starts with eight pawns. White's pawns are located in the second rank, while Black's pawns are located in the seventh rank. The pawn is the least powerful piece and is worth one point. If it is a pawn's first move, it can move forward one or two squares. If a pawn has already moved, then it can move forward just one square at a time. It attacks (or captures) each square diagonally to the left or right. In the following diagram, the pawn has just moved from the e2-square to the e4-square and attacks the squares d5 and f5.

The Bishop

Each side starts with two bishops, one on a light square and one on a dark square. When a game begins, White's bishops are located on c1 and f1, while Black's bishops are located on c8 and f8. The bishop is considered a minor piece (like a knight) and is worth three points. A bishop can move diagonally as many squares as it likes, as long as it is not blocked by its own pieces or an occupied square. An easy way to remember how a bishop can move is that it moves like an "X" shape. It can capture an enemy piece by moving to the occupied square where the piece is located.

The Knight

Each side starts with two knights—a king's knight and a queen's knight. When a game starts, White's knights are located on b1 and g1, while Black's knights are located on b8 and g8. The knight is considered a minor piece (like a bishop) and is worth three points. The knight is the only piece in chess that can jump over another piece! It moves one square left or right horizontally and then two squares up or down vertically, OR it moves two squares left or right horizontally and then one square up or down vertically—in other words, the knight moves in an "L-shape." The knight can capture only what it lands on, not what it jumps over!

The Rook

Each side starts with two rooks, one on the queenside and one on the kingside. All four rooks are located in the corners of the board. White's rooks start the game on a1 and h1, while Black's rooks are located on a8 and h8. The rook is considered a major piece (like the queen) and is worth five points. It can move as many squares as it likes left or right horizontally, or as many squares as it likes up or down vertically (as long as it isn't blocked by other pieces).

The Queen

The queen is the most powerful chess piece! When a game begins, each side starts with one queen. The white queen is located on d1, while the black queen is located on d8. The queen is considered a major piece (like a rook) and is worth nine points. It can move as many squares as it likes left or right horizontally, or as many squares as it likes up or down vertically (like a rook). The queen can also move as many squares as it likes diagonally (like a bishop).

The King

The king is the most important chess piece. The goal of a game of chess is to checkmate the king. When a game starts, each side has one king. White's king is located on e1, while Black's king starts on e8.

2.4 PROBLEM STATEMENT

Chess is a game where the battle of minds takes place between two people. It is a game of strategy where two people play with each other’s minds. It’s a board game that requires patience, concentration, intuition, perseverance, etc. Chess is a mind game that involves a lot of thinking and time. It requires prediction and problem-solving skills. We are living in a world that is connected despite being in different locations. So we have the ability to play and challenge other people with games. The project focuses on a chess game that anyone can play online with someone or by themselves. The main goal is to allow the gamer to have a good experience of the play but also connect with the opponent player and learn and discuss chess moves.

3. REQUIREMENTS

HMI principles implemented in the project

Place Users at the Centre

As always, the first UI design principle is to focus on people (or, the "user" aswe all say). A good user interface is easy and natural to use, avoids confusingthe user, and does what the user needs. Learning about human-centred design will help you achieve the right mindset for the best interfaces and focus on people first, and design second.

Strive for Clarity

The purpose of the user interface is to allow the user to interact with the website or application (or, more generally in broader design, any product). Avoid anything that confuses people or doesn't help them interact.

Minimise Actions and Steps Per Screen

Streamline tasks and actions so they can be done in as few steps as possible.Each screen should have one primary focus. Keep the primary action front and centre and move secondary actions deeper on a page or give them lightervisual weight and the right typography.

Aim for Simplicity

Classics exist for a reason; they're timeless and never go out of style, thoughthey do benefit from modern touches. A user interface should be simple andelegant.

Be Consistent

Consistency creates familiarity, and familiar interfaces are naturally more usable. Consistent design reduces friction for the user. A consistent design ispredictable. Predictable design means it's easy to understand how to use functions without instruction. Not only should UI design be consisten

internally, but externally as well. A design system is a great way to ensureconsistency in UI design.

Your Goal: Make Your User Interface Design Invisible

Don't draw attention to your user interface. A great UI allows people to use the product without friction, not spend time figuring out how to interact with the product.

Provide Useful Feedback

Feedback can be visual, audio (the ding of a new message alert), or sense oftouch. Every action should have feedback to indicate whether the action wassuccessful or not.

Feedback helps to answer questions in four areas:

Location: You are here.

Status: What's going on Is it still going on

Future status: What's next

Outcomes & Results: Hey, what happened.

Hovering over a navigation item that then changes colour indicates an item isclickable. Buttons should look like buttons. Feedback lets the user know if they're doing the right thing (or the wrong thing).

Reduce Cognitive Load

Many of these UI design principles serve to reduce cognitive load for users.

Basically, don't make users think (also a useful UX design principle as well).

Make It Accessible

UI designs need to take into account accessibility issues. Online, this often means ensuring the visibly impaired can access and use the product.

Flexible

Create a UI that will work and look great across multiple platforms. It may have to be tweaked depending on the form factor of a device and its

operating system (Android and iOS, for example), but it should be flexibleenough to work on anything.

Visual Structure

Keep a consistent visual structure to create familiarity and relieve user anxiety by making them feel at home. A few elements to focus on include a visual hierarchy with the most important things made obvious, colour scheme, consistent navigation, re-use elements, and creating a visual order using grids.

Dialogues Should Result in Closure

Actions should have a beginning, middle, and end (with feedback at each step). For example, when making an online purchase we move from browsingand product selection to the checkout and then finally confirmed that the purchase is completed.

Provide a Clear Next Step

Include a clear next step a user can take after an interaction. That could be assimple as a “back to top” click at the end of a long blog post or a pointer to more information. Help the user achieve their goals with the next step.

NodeJs

Node.js is an open-source and cross-platform JavaScript runtime environment. It is a popular tool for almost any kind of project!

Node.js runs the V8 JavaScript engine, the core of Google Chrome, outside ofthe browser. This allows Node.js to be very performant.

A Node.js app runs in a single process, without creating a new thread for every request. Node.js provides a set of asynchronous I/O primitives in its standard library that prevent JavaScript code from blocking and generally, libraries in Node.js are written using non-blocking paradigms, making blocking behaviour the exception rather than the norm.

When Node.js performs an I/O operation, like reading from the network, accessing a database or the filesystem, instead of blocking the thread and

wasting CPU cycles waiting, Node.js will resume the operations when the response comes back.

This allows Node.js to handle thousands of concurrent connections with a single server without introducing the burden of managing thread concurrency, which could be a significant source of bugs.

Node.js has a unique advantage because millions of frontend developers thatwrite JavaScript for the browser are now able to write the server-side code inaddition to the client-side code without the need to learn a completely different language.

In Node.js the new ECMAScript standards can be used without problems, as you don't have to wait for all your users to update their browsers - you are in charge of deciding which ECMAScript version to use by changing the Node.js version, and you can also enable specific experimental features by running Node.js with flags.

Socket Programming

A socket is a communication connection point (endpoint) that you can name and address in a network. Socket programming shows how to use socketAPIs to establish communication links between remote and local processes.

The processes that use a socket can reside on the same system or different systems on different networks. Sockets are useful for both stand-alone and network applications. Sockets allow you to exchange information between processes on the same machine or across a network, distribute work to the most e cient machine, and they easily allow access to centralised data. Socket application program interfaces (APIs) are the network standard for TCP/IP. A wide range of operating systems support socket APIs. i5/OSsockets support multiple transports and networking protocols. Socket system functions and the socket network functions are thread-safe.

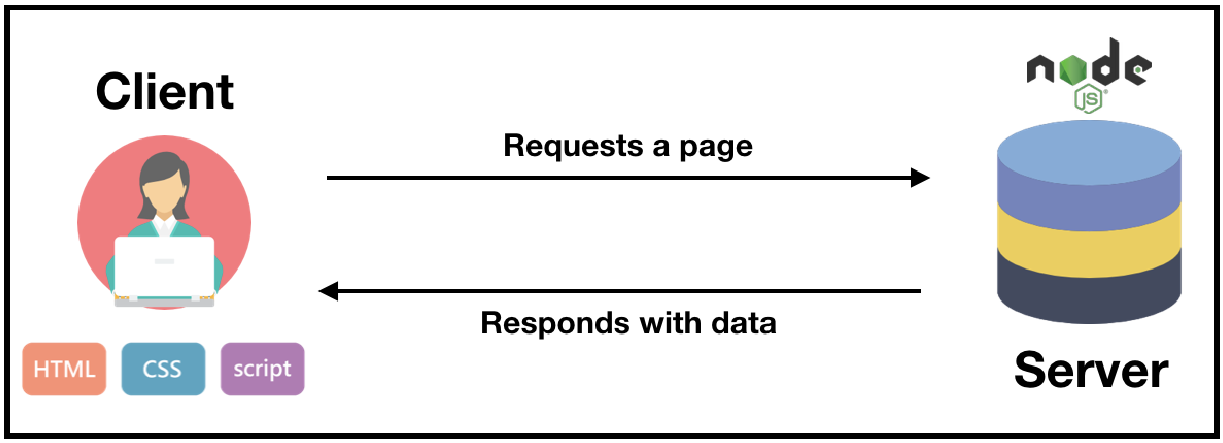


Figure 2: Socket Programming with Nodejs

Heroku

The project is hosted on Heroku which is a cloud Platform as a container-based Service (PaaS). Heroku is used by developers to launch, manage, and grow contemporary programs. Heroku is an open-source software platform for machine learning and data science that makes it simple to develop and publish attractive, bespoke web apps. The benefit of web apps is that they are platform agnostic and may be operated by anybody with an Internet connection. Their code is run on a back-end server, which processes incoming requests and answers using a common protocol that all browsers can understand.

Deployment:
Install dependencies of node js using packages.json
Build and run the app locally using the command heroku local web
Create git and commit the changes
Deploy application on Heroku using CLI
To open the app, type heroku open.

4. IMPLEMENTATION

App.js

```
const formEl = document.querySelectorAll('#joinForm > div > input') const joinButtonEl = document.querySelector('#joinButton')
const messageEl = document.querySelector('#message') const statusEl = document.querySelector('#status') const ChatEl = document.querySelector('#chat')
const sendButtonEl = document.querySelector('#send') const roomsListEl = document.getElementById('roomsList'); const myAudioEl = document.getElementById('myAudio');
const singlePlayerEl = document.getElementById('singlePlayer'); const multiPlayerEl = document.getElementById('multiPlayer'); const totalRoomsEl = document.getElementById('rooms')
const totalPlayersEl = document.getElementById('players') const chatContentEl = document.getElementById('chatContent') var config = {};
var board = null;
var game = new Chess()var turnt = 0;

// initializing semantic UI dropdown
$('.ui.dropdown')
.dropdown();

// function for defining onchange on dropdown menus
$("#roomDropdown").dropdown({ onChange: function (val) {
console.log(val) console.log('running the function') formEl[1].value = val
}
});
```

```
function onDragStart2(source, piece, position, orientation) {
// do not pick up pieces if the game is overif (game.game_over()) {
if (game.in_draw()) {
alert('Game Draw!!');
}
else  if  (game.in_checkmate())if (turnt === 1) {
alert('You won the game!!');
} else {
alert('You lost!!');
}
return false
}


// only pick up pieces for White
if (piece.search(/^b/) !== -1) return false
}


function makeRandomMove() {
var possibleMoves = game.moves()

// game over
if (possibleMoves.length === 0) {return;
}


var randomIdx = Math.floor(Math.random() * possibleMoves.length)
game.move(possibleMoves[randomIdx]);
myAudioEl.play();turnt = 1 - turnt;
board.position(game.fen());
```

```
function onDrop2(source, target) {
// see if the move is legalvar move = game.move({
from: source,to: target,
promotion: 'q' // NOTE: always promote to a queen for example simplicity
})
myAudioEl.play();
// illegal move
if (move === null) return 'snapback'turnt = 1 - turnt;
// make random legal move for black window.setTimeout(makeRandomMove,   250)
}
// update the board position after the piece snap
// for castling, en passant, pawn promotionfunction onSnapEnd2() {
board.position(game.fen())
}

singlePlayerEl.addEventListener('click',  (e)  =>  {  e.preventDefault();
document.getElementById('gameMode').style.display  =  ''none'';
document.querySelector('#chessGame').style.display = null; config = {
draggable: true,position: 'start',
onDragStart:  onDragStart2,onDrop: onDrop2, onSnapEnd: onSnapEnd2
}
board = Chessboard('myBoard', config);
})
```

```
//Connection will be established after webpage is refreshedconst socket = io()
//Triggers after a piece is dropped on the boardfunction onDrop(source, target) {
//emits event after piece is droppedvar room = formEl[1].value; myAudioEl.play();
socket.emit('Dropped', { source, target, room })
}
//Update Status Event
socket.on('updateEvent', ({ status, fen, pgn }) => { statusEl.textContent = status
fenEl.textContent = fen
pgnEl.textContent = pgn
})
socket.on('printing', (fen) => { console.log(fen)
})
//Catch Display event
socket.on('DisplayBoard', (fenString, userId, pgn) => { console.log(fenString)
//This is to be done initially onlyif (userId != undefined) {
messageEl.textContent = 'Match Started!! Best of Luck...' if (socket.id == userId) {
config.orientation = 'black'
}
document.getElementById('joinFormDiv').style.display = "none";
document.querySelector('#chessGame').style.display = null ChatEl.style.display = null
document.getElementById('statusPGN').style.display = null
}
```

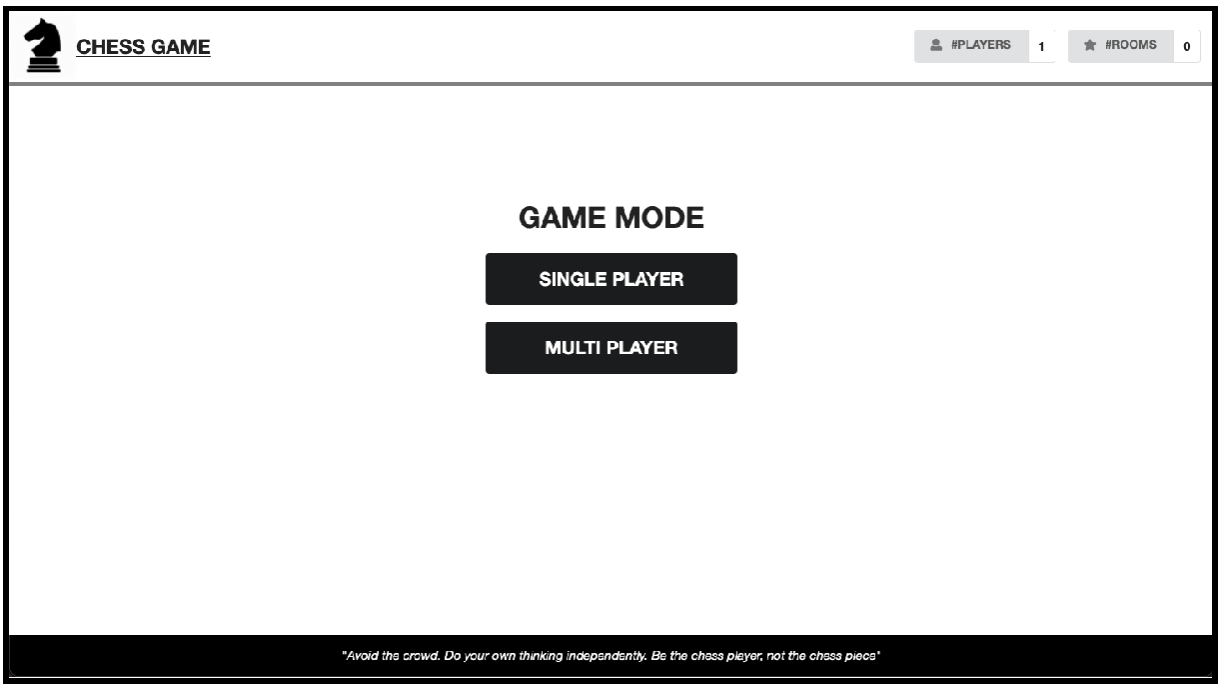
```
config.position = fenString
board = ChessBoard('myBoard', config) document.getElementById('pgn').textContent = pgn
})
//To turn off dragging socket.on('Dragging', id => {
if (socket.id != id) { config.draggable = true;
} else {
config.draggable = false;
}
})
//To Update Status Element socket.on('updateStatus', (turn) => {
if (board.orientation().includes(turn)) {statusEl.textContent = "Your turn"
}
else {
statusEl.textContent = "Opponent's turn"
}
})
//If in check socket.on('inCheck', turn => {
if (board.orientation().includes(turn)) { statusEl.textContent = "You are in Check!!"
}
else {
statusEl.textContent = "Opponent is in Check!!"
}
})
//If win or draw socket.on('gameOver', (turn, win) => {
config.draggable = false;
```

```
if (win) {
if   (board.orientation().includes(turn))   { statusEl.textContent = "You lost, better luck next time
:)"
}
else {
statusEl.textContent = "Congratulations, you won!!"
}
}
else {
statusEl.value = 'Game Draw'
}
})
```

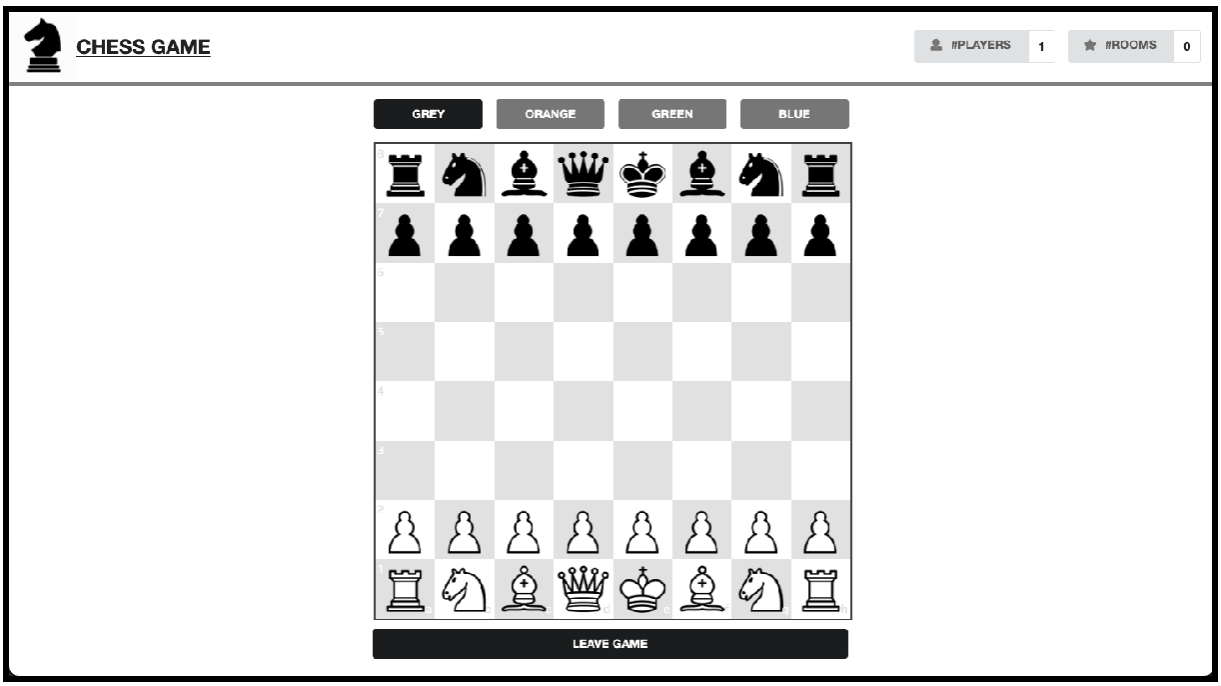
5. RESULTS AND ANALYSIS

Web Application: https://onlinechess-game.herokuapp.com

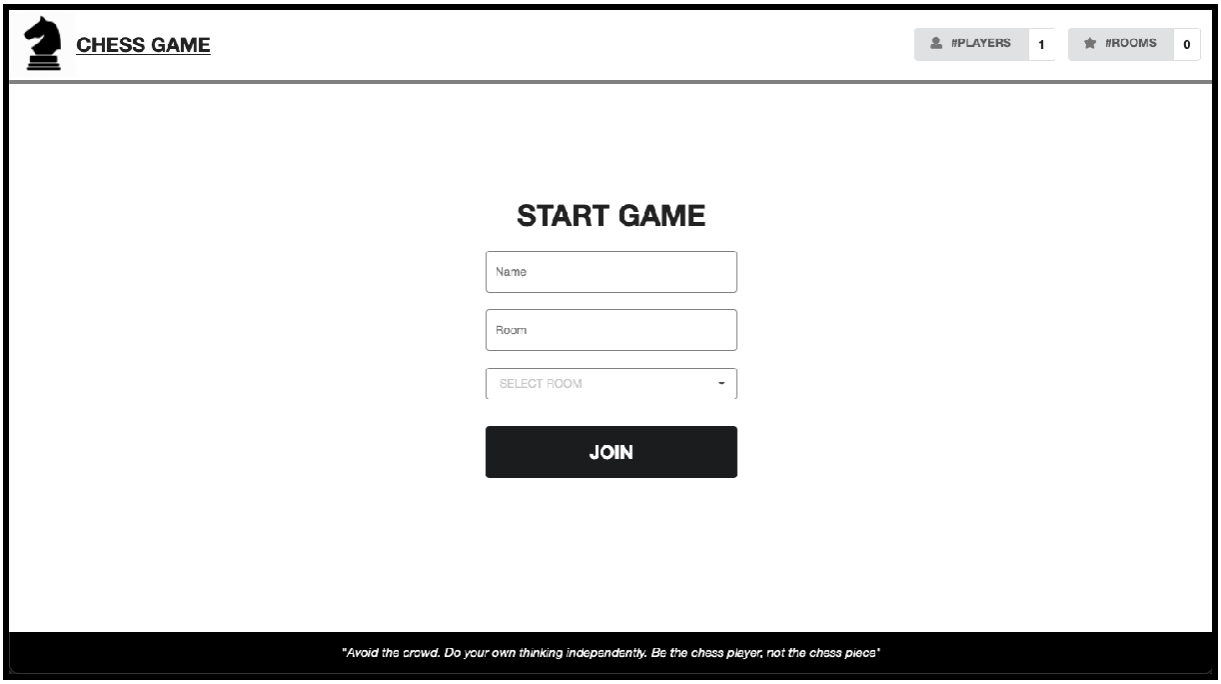
Home Page

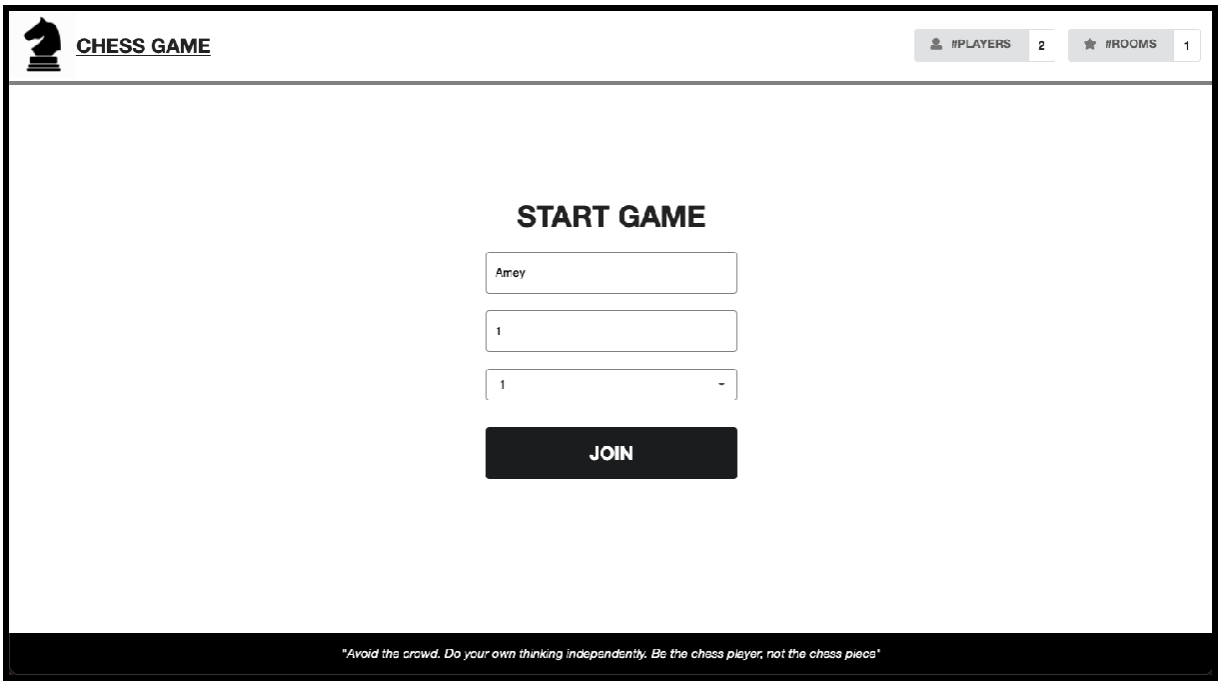


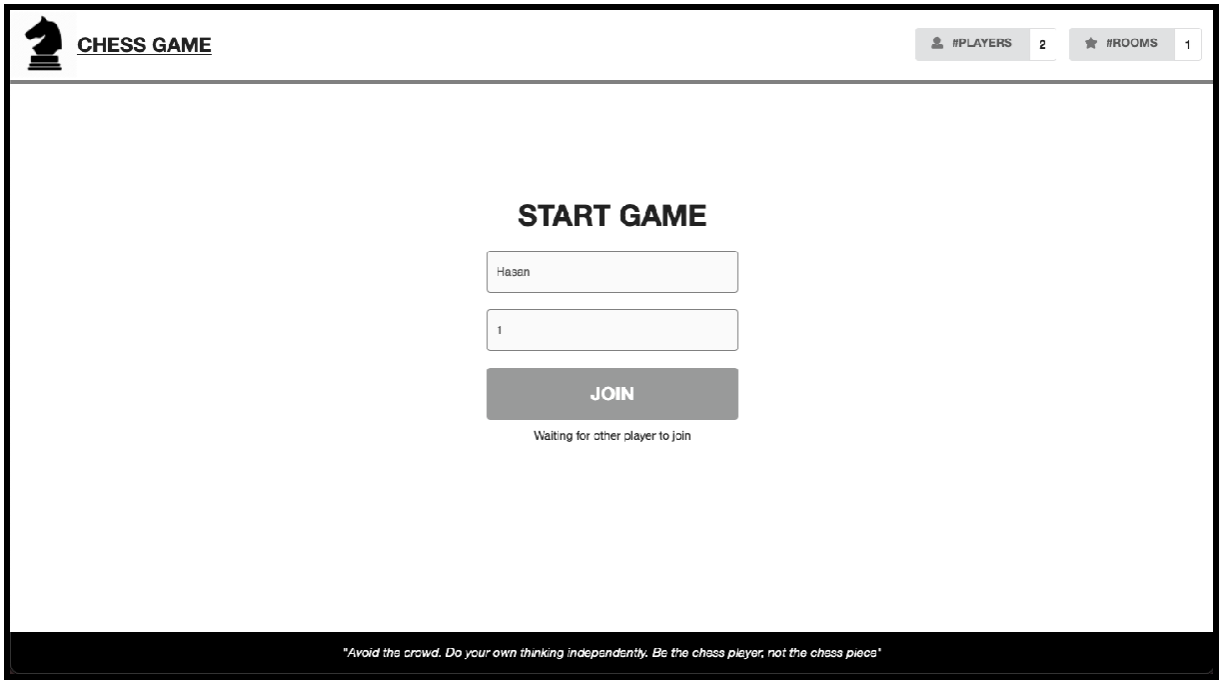
Single Player Mode

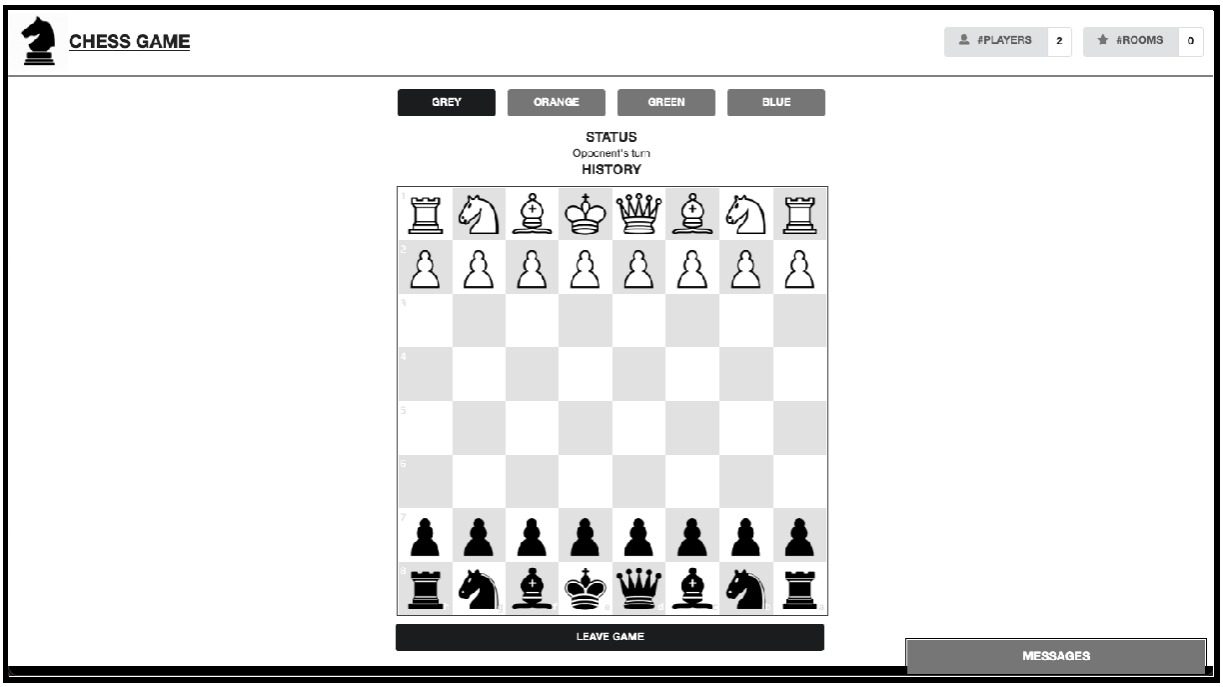


Multiplayer Mode

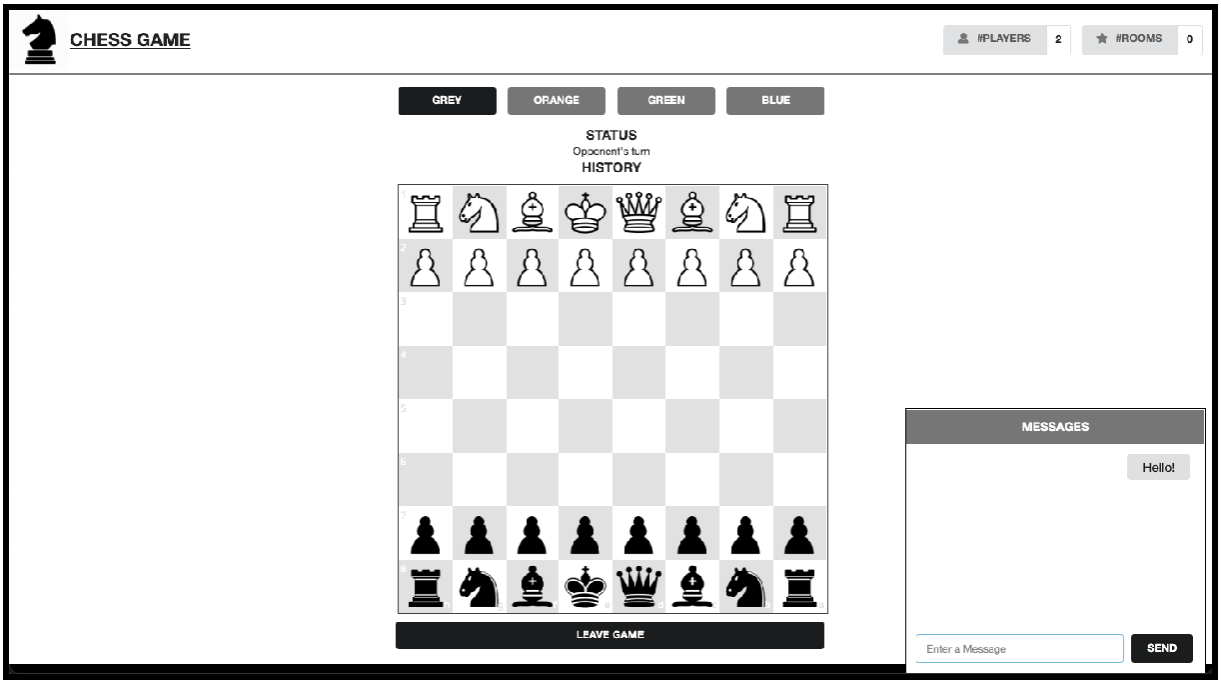


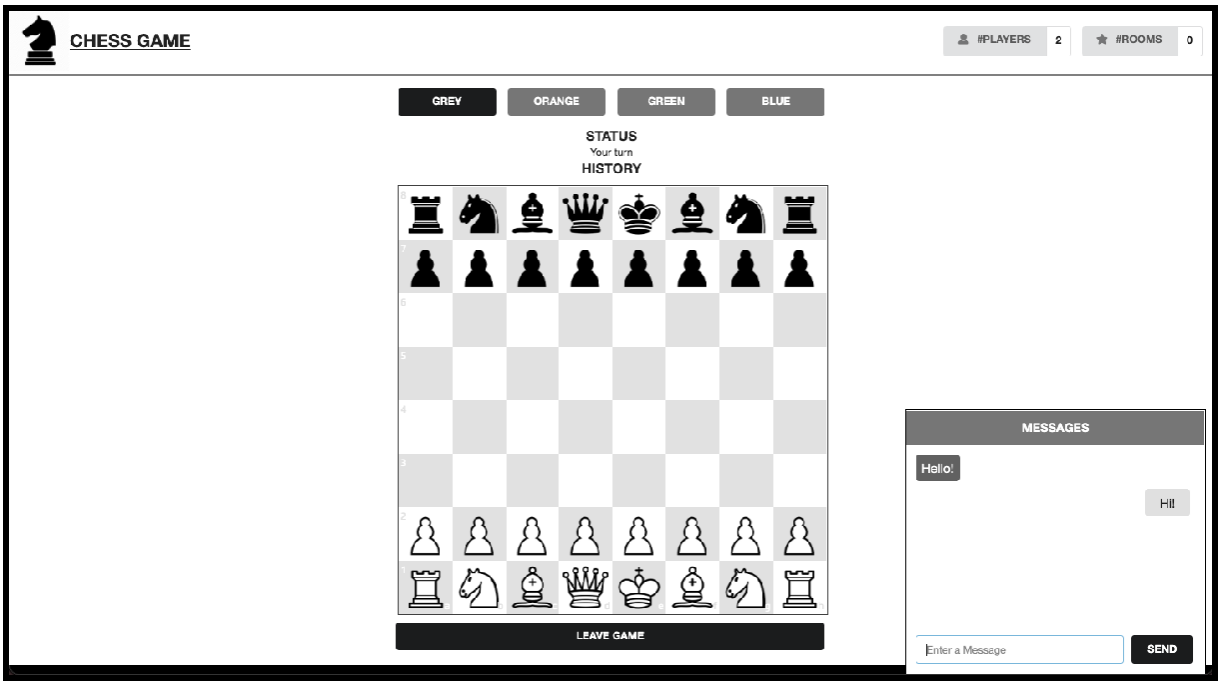



CHESS GAME
#PLAYERS 2
#ROOMS 1
START GAME
Hasen
1
JOIN
Waiting for other player to join
"Avoid the crowd. Do your own thinking independently. Be the chess player, not the chess piece"


CHESS GAME
#PLAYERS 2
#ROOMS 0
GREY
ORANGE
GREEN
BLUE
STATUS
Opponent's turn
HISTORY
LEAVE GAME
MESSAGES

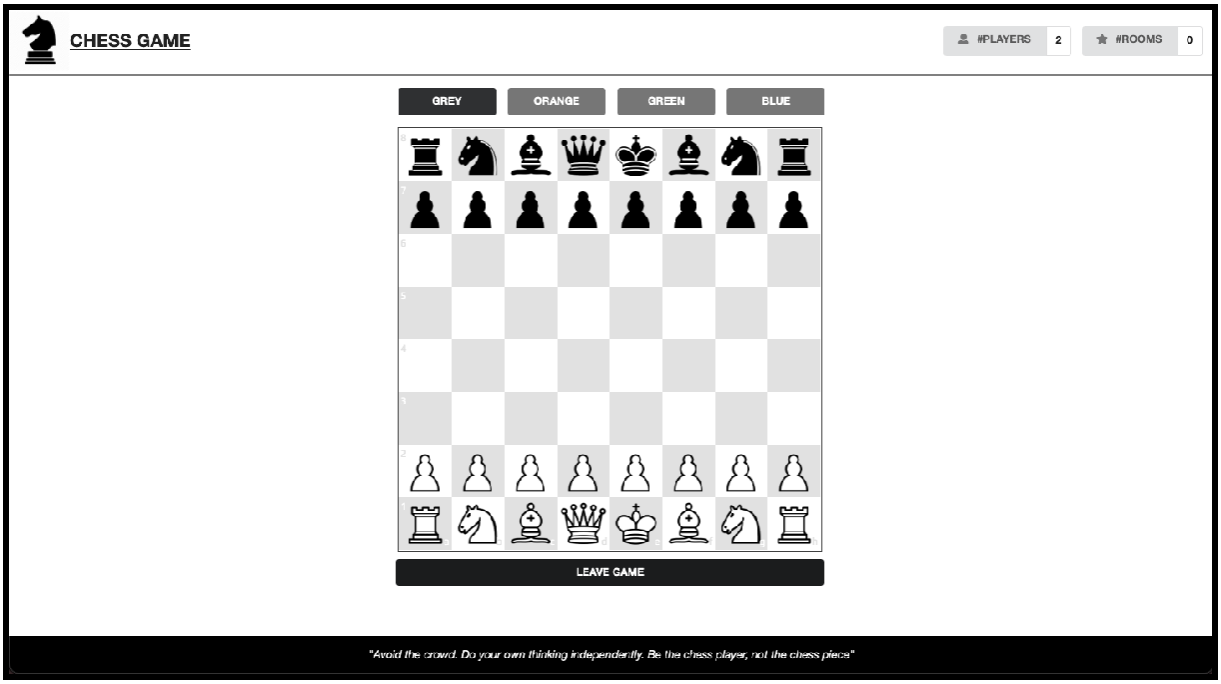
Chat window for players to send message to each other



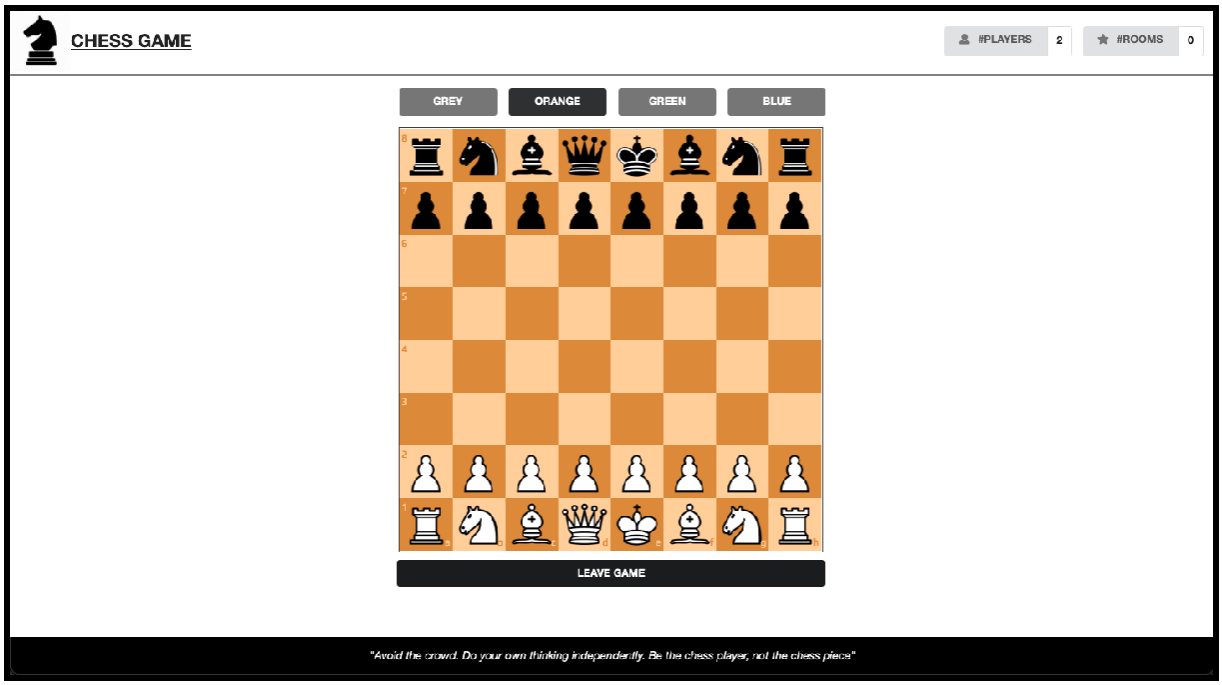


Different Colour Themes:

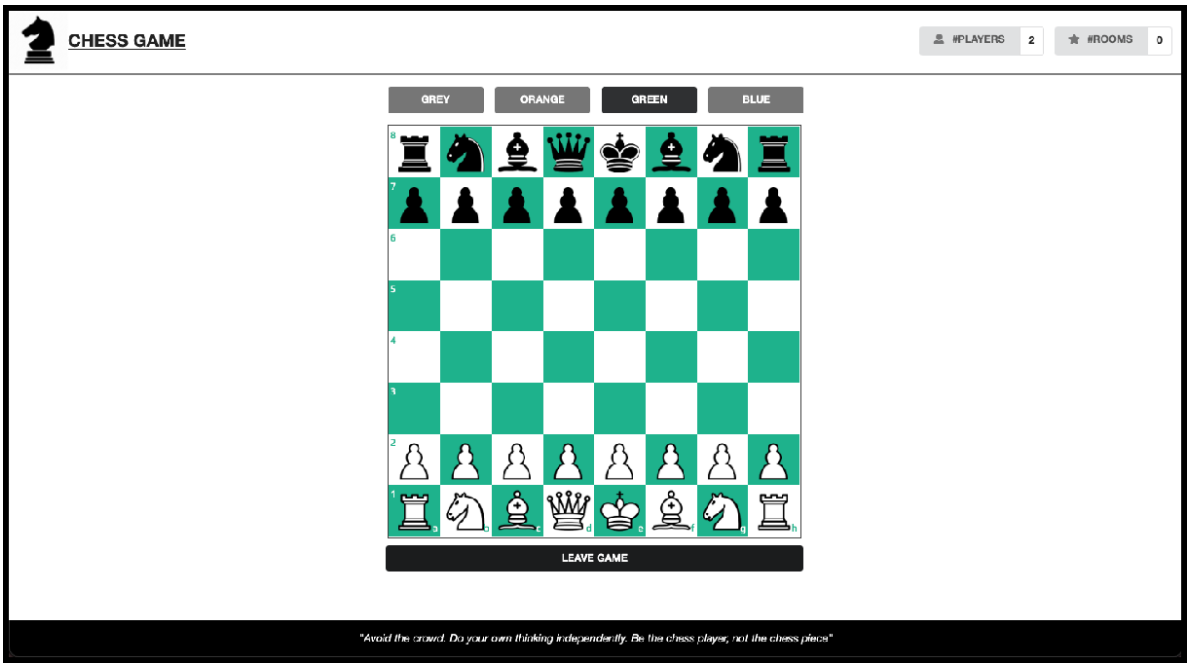
Grey



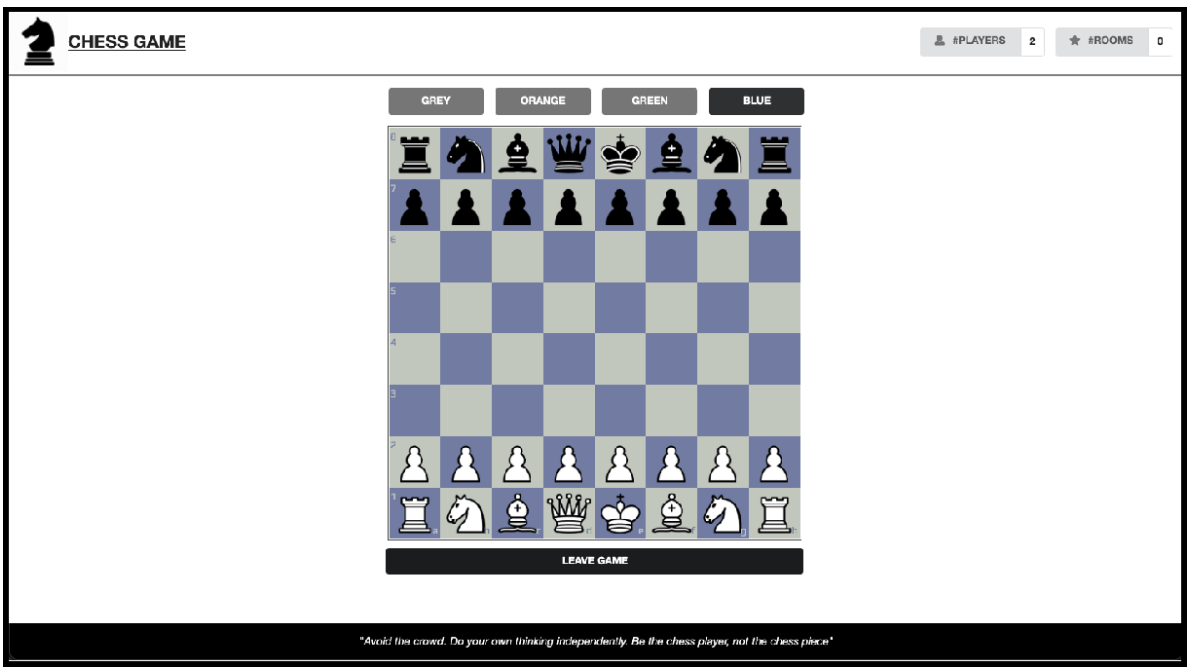
Orange



Green


CHESS GAME
#PLAYERS 2
#ROOMS 0
GREY
ORANGE
GREEN
BLUE
LEAVE GAME
"Avoid the crowd. Do your own thinking independently. Be the chess player, not the chess piece"

Blue


CHESS GAME
#PLAYERS 2
#ROOMS 0
GREY
ORANGE
GREEN
BLUE
LEAVE GAME
"Avoid the crowd. Do your own thinking independently. Be the chess player, not the chess piece"

6. CONCLUSION AND FUTURE ENHANCEMENT

Through the proposed system, we can draw the conclusion that the online chess game is designed by keeping in mind the Human-Machine Interaction principles. The web application is simple and allows the user to play chess. Two modes are available: the first one is single-player and the second one is multiplayer. In the case of multiplayer, the user can communicate with the opponent through a chat window. The design of the website is classic and elegant with fewer colours and objects on it and the goal is very clear to the user: playing chess. The user has the choice to change the theme of the game as well. While playing, the user gets to know about the possible movement of the pieces. For multiple player mode, if the opponent leaves the game in the middle, the browser notifies that the opponent has left the game. The user is well informed of everything that is happening and can take decisions without thinking too much.

The web application developed using Nodejs was deployed on the Heroku platform and can be accessed by everyone. Furthermore, for future work, we can add more features and also make a tutorial portal for new beginners with tips on how to play.

7. REFERENCES AND ROLE OF EACH PERSON

https://www.chess.com/terms/chess-pieces
https://nodejs.org/en/docs
https://devcenter.heroku.com/categories/reference
https://devcenter.heroku.com/articles/getting-started-with-nodejs

1. Mohammed Basheeruddin – UI/UX
2. Anas Ahmed Ather - HTML
3. Vanshaj Bhardwaj - CSS
4. Prithvi Singh Kirar - Backend