BASIC OPERATIONS ON MESSAGE QUEUES

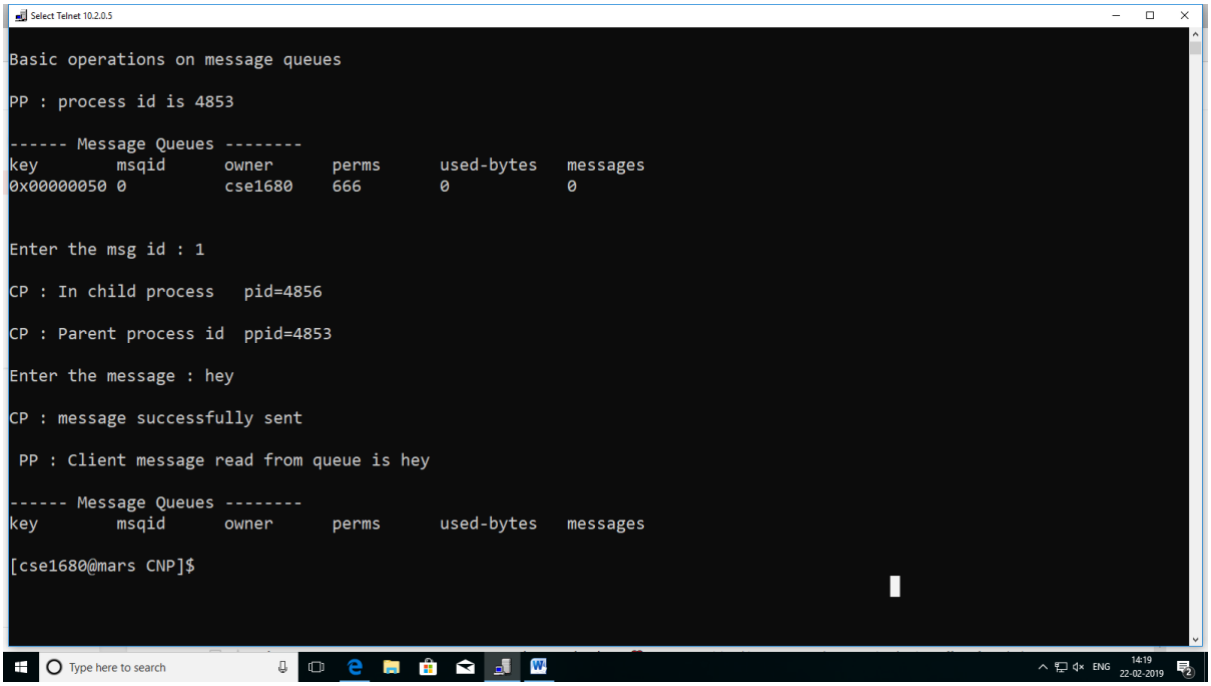
(SHARED PROCESS ADDRESS SPACE)

Program:

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<sys/ipc.h>
#include<sys/msg.h>

typedef struct msg
{
	long id;
	char txt[10];
}message;
main()
{
	int mqid,pid,rval,msgid;
	system("clear");
	printf("\nBasic operations on message queues\n");
	printf("\nPP : process id is %d\n",getpid());
	mqid=msgget((key_t)80,IPC_CREAT|0666);
	if(mqid==-1)
	{
		perror("PP : MQ-CRE-ERR");
		exit(1);
	}
	system("ipcs -q");
	printf("\nEnter the msg id : ");
	scanf("%d",&msgid);
	pid=fork();
	if(pid==-1)
	{
		perror("PP : FRK-ERR");
		msgctl(mqid,IPC_RMID,0);
		system("ipcs -q");
```

```
		exit(1);
	}
	if(pid==0)
	{
		message m1;
		printf("\nCP : In child process\tpid=%d\n",getpid());
		printf("\nCP : Parent process id\tppid=%d\n",getppid());
		//printf("\nCP : Enter msgid\t:\t");
		//scanf("%d",&m1.id);
		m1.id=msgid;
		printf("\nEnter the message : ");
		scanf("%s",m1.txt);
		rval=msgsnd(mqid,(message*)&m1,sizeof(m1),0);
		if(rval==-1)
			perror("\nCP : Unable to send message\n");
		else
			printf("\nCP : message successfully sent\n");
	}
	else
	{
		message m2;
		rval=msgrcv(mqid,(message*)&m2,sizeof(m2),msgid,0);
		if(rval==-1)
			perror("\nPP : No message read\n");
		else
			printf("\n PP : Client message read from queue is %s\n",m2.txt);
		rval=msgctl(mqid,IPC_RMID,0);
		system("ipcs -q");
	}
}
```

OUTPUT:



```
Basic operations on message queues

PP : process id is 4853

------ Message Queues --------
key        msqid      owner      perms      used-bytes   messages
0x00000050 0          cse1680    666        0            0


Enter the msg id : 1

CP : In child process   pid=4856

CP : Parent process id  ppid=4853

Enter the message : hey

CP : message successfully sent

 PP : Client message read from queue is hey

------ Message Queues --------
key        msqid      owner      perms      used-bytes   messages

[cse1680@mars CNP]$
```

BASIC OPERATIONS ON MESSAGE QUEUES

(NON-SHARED PROCESS ADDRESS SPACE)

Program:

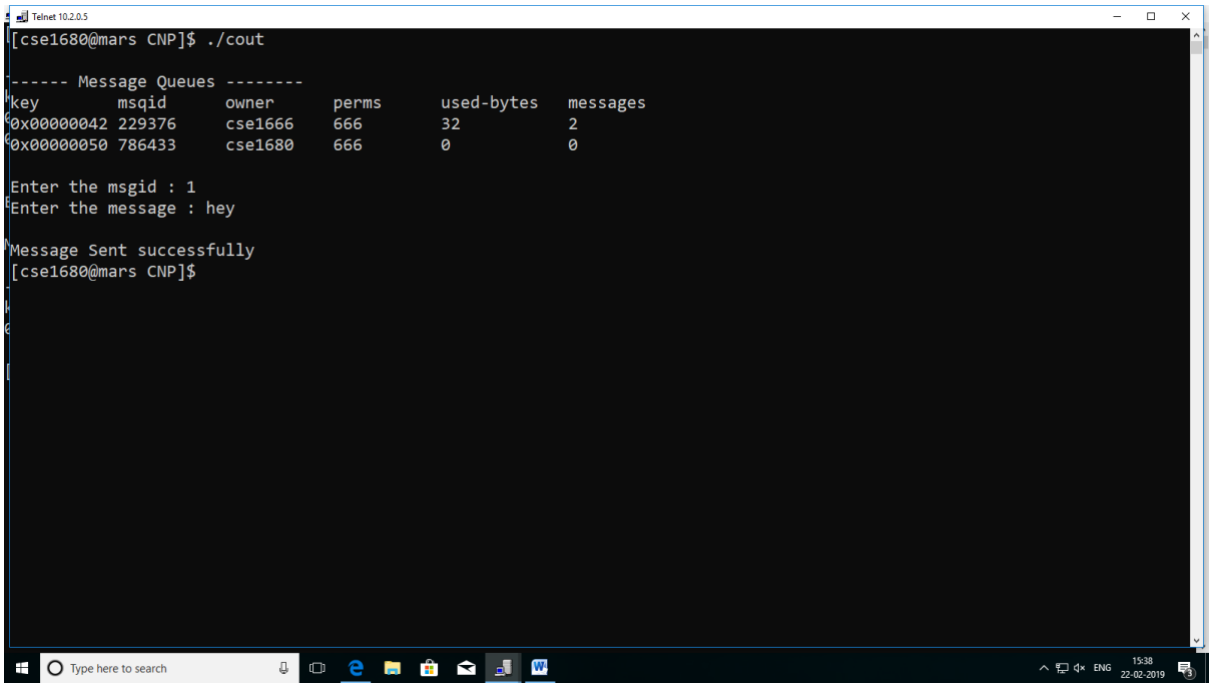
```
/*CLIENT PROGRAM*/
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<sys/ipc.h>
#include<sys/msg.h>

typedef struct msg
{
	long id;
	char txt[10];
}message;

main()
{
	int mqid,rval,msgid;
	message m1;
	mqid=msgget((key_t)80,IPC_CREAT|0666);
	if(mqid==-1)
	{
		perror("MQ-CRE-ERR");
		exit(1);
	}
	system("ipcs -q");
	printf("Enter the msgid : ");
	scanf("%d",&msgid);
	m1.id=msgid;
	printf("Enter the message : ");
	scanf("%s",m1.txt);
	rval=msgsnd(mqid,(message*)&m1,sizeof(m1),0);
	if(rval==-1)
		perror("\nMessage not sent\n");
```

```
	else
		printf("\nMessage Sent successfully\n");
}
/*SERVER PROGRAM*/
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<sys/ipc.h>
#include<sys/msg.h>

typedef struct msg
{
	long id;
	char txt[10];
}message;

main()
{
	int mqid,rval,msgid;
	message m2;
	mqid=msgget((key_t)80,IPC_CREAT|0666);
	if(mqid==-1)
	{
		perror("MQ-CRE-ERR");
		exit(1);
	}
	system("ipcs -q");

	printf("\nEnter the msgid :");
	scanf("%d",&msgid);
	rval=msgrcv(mqid,(message*)&m2,sizeof(m2),msgid,0);
	if(rval==-1)
	{
		perror("No message read");
		msgctl(mqid,IPC_RMID,0);
		system("ipcs -q");
		exit(1);
```

```
        }
        printf("\nMessage entered : %s\n",m2.txt);
        msgctl(mqid,IPC_RMID,0);
        system("ipcs -q");
}
```

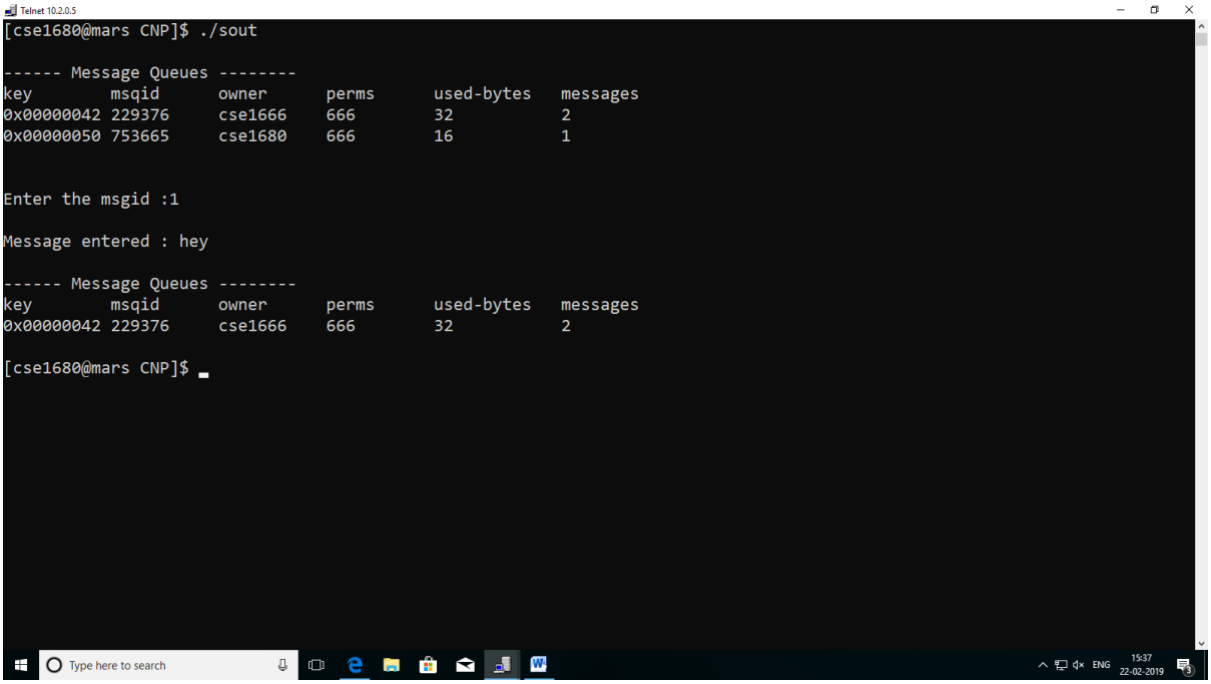
OUTPUT:

CLIENT



```
[cse1680@mars CNP]$ ./cout

------ Message Queues --------
key        msqid      owner      perms      used-bytes   messages
0x00000042 229376     cse1666    666        32           2
0x00000050 786433     cse1680    666        0            0

Enter the msgid : 1
Enter the message : hey

Message Sent successfully
[cse1680@mars CNP]$
```

SERVER



```
[cse1680@mars CNP]$ ./sout

------ Message Queues --------
key        msqid      owner      perms      used-bytes   messages
0x00000042 229376     cse1666    666        32           2
0x00000050 753665     cse1680    666        16           1


Enter the msgid :1

Message entered : hey

------ Message Queues --------
key        msqid      owner      perms      used-bytes   messages
0x00000042 229376     cse1666    666        32           2

[cse1680@mars CNP]$
```

UDP CLIENT TO ACCESS WELL KNOWN / STANDARD PORT SERVICE

Program:

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/socket.h>
#include<netinet/in.h>
#include<sys/types.h>
#include<string.h>
main(int argc,char* argv[])
{
	struct sockaddr_in s,c; //sockets for server and client
	int rval,sockid,slen;
	char m1[20],m2[20];
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP-Address Port#\n",argv[0]);
		exit(1);
	}
	sockid=socket(PF_INET,SOCK_DGRAM,17);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR:");
		exit(1);
	}
	s.sin_family=PF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);
	c.sin_port=htons(5080);

	printf("\nEnter the request message : ");
	scanf("%s",m1);
	slen=sizeof(s);
	rval=sendto(sockid,m1,sizeof(m1),0,(struct sockaddr*)&s,slen);
	if(rval==-1)
```

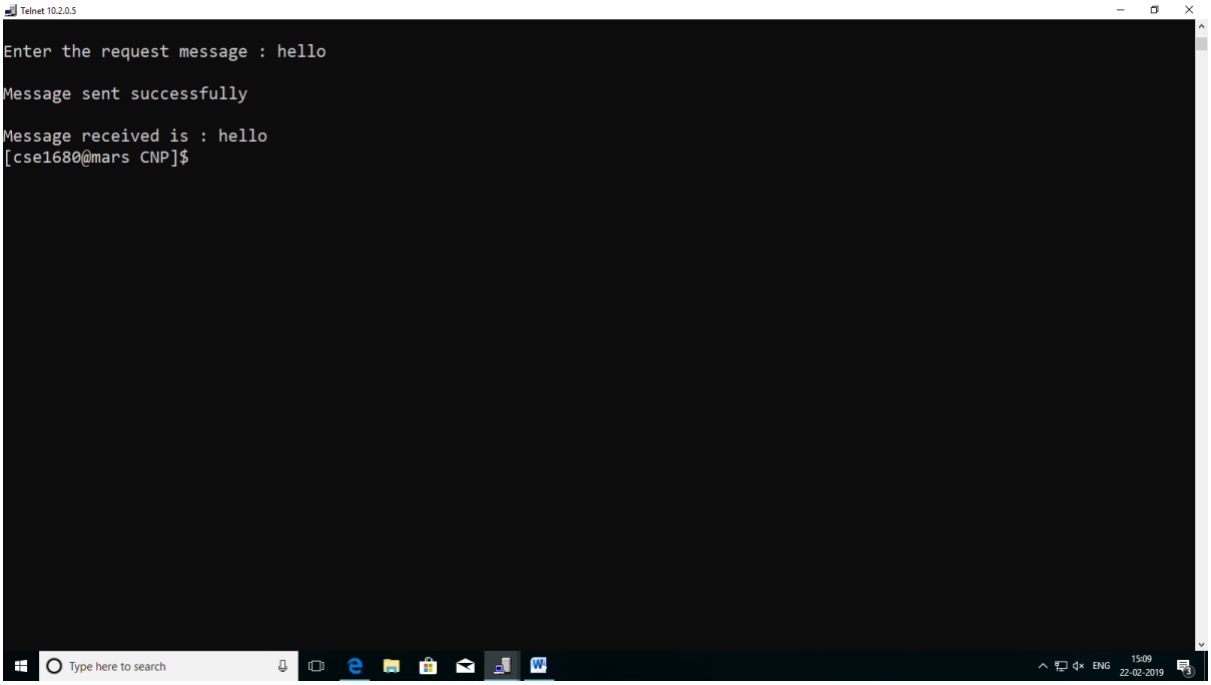
```
        {
                perror("MSG-SEND-ERR:");
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        strncpy(m2," ",20);
        rval=recvfrom(sockid,m2,sizeof(m2),0,(struct sockaddr*)&s,&slen);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                exit(1);
        }
        printf("\nMessage received is : %s\n",m2);
        close(sockid);
}
```

OUTPUT:

compilation : gcc –o cout udp_client.c

execution : ./cout 10.2.0.7 7 (7 is the port for standard echo service)

CLIENT

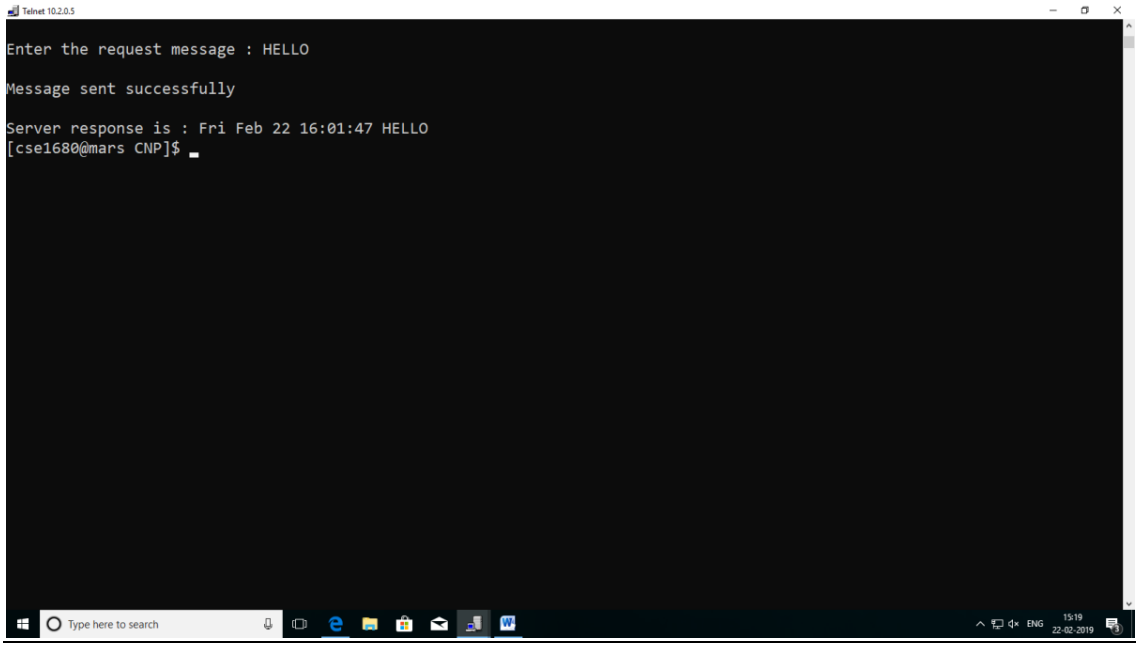


OUTPUT:

compilation : gcc –o cout udp_client.c

execution : ./cout 10.2.0.5 13 (13 is the port for standard daytime service)

CLIENT

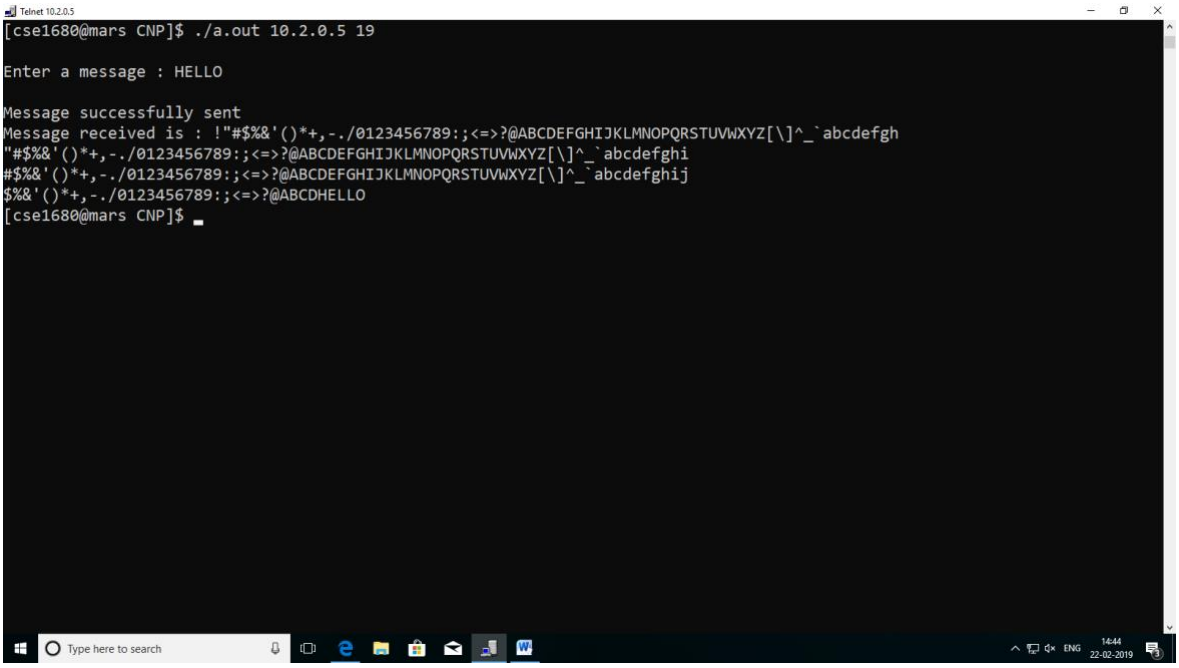


OUTPUT:

compilation : gcc –o cout udp_client.c

execution : ./cout 10.2.0.5 19 (19 is the port for standard char-gen service)

CLIENT



TCP CLIENT TO ACCESS WELL KNOW SERVICE/STANDARD PORT SERVICE

Program:

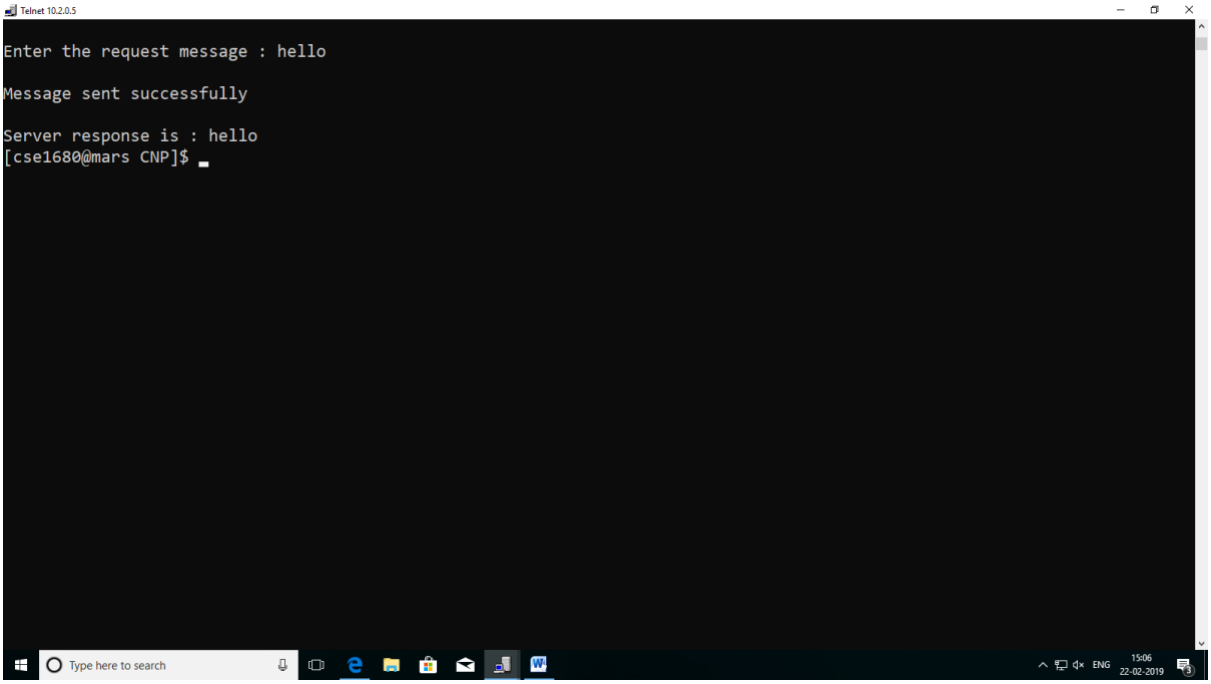
```
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<sys/socket.h>
#include<netinet/in.h>

main(int argc,char* argv[])
{
	int sockid,rval;
	char m1[20],m2[20];
	sockid=socket(AF_INET,SOCK_STREAM,0);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR");
		exit(1);
	}
	struct sockaddr_in s;
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(0);
	}
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	rval=connect(sockid,(struct sockaddr*)&s, sizeof(s));
	if(rval==-1)
	{
		perror("CONN-ERR:");
		close(sockid);
		exit(1);
```

```
        }
        printf("\nEnter the request message : ");
        scanf("%s",m1);
        rval=send(sockid,m1,sizeof(m1),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        rval=recv(sockid,m2,sizeof(m2),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nServer response is : %s\n",m2);
        close(sockid);
}
```

OUTPUT:

compilation : gcc –o cout tcp_client.c

execution : ./cout 10.2.0.7 7 (7 is the port for standard echo service)

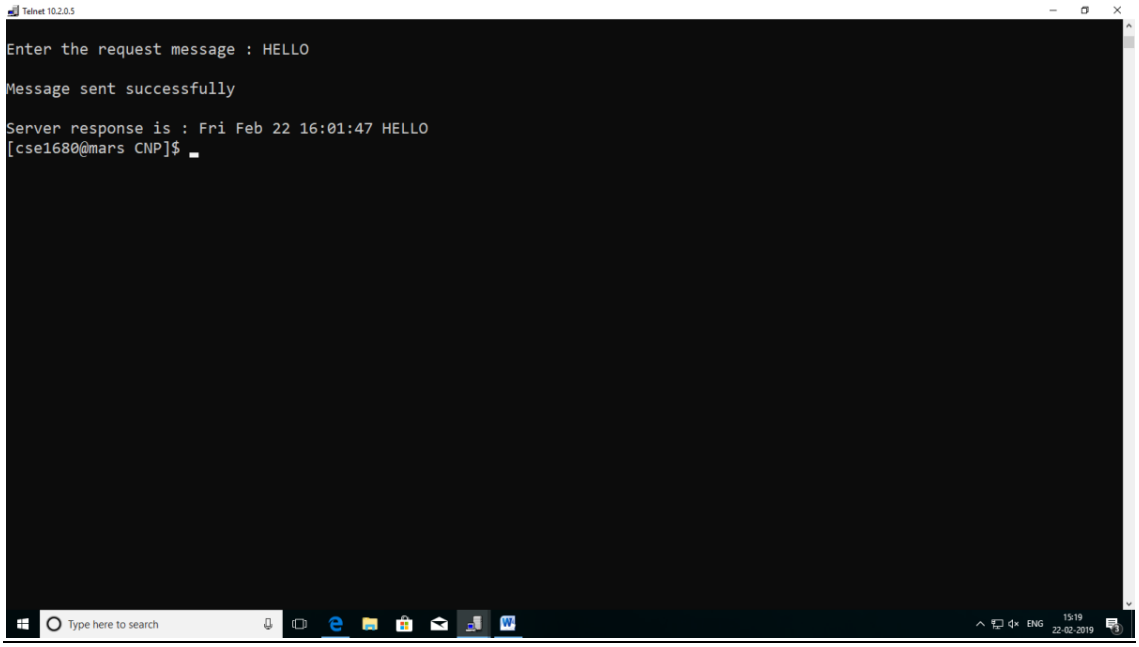


OUTPUT:

compilation : gcc –o cout tcp_client.c

execution : ./cout 10.2.0.5 13 (13 is the port for standard daytime service)

CLIENT

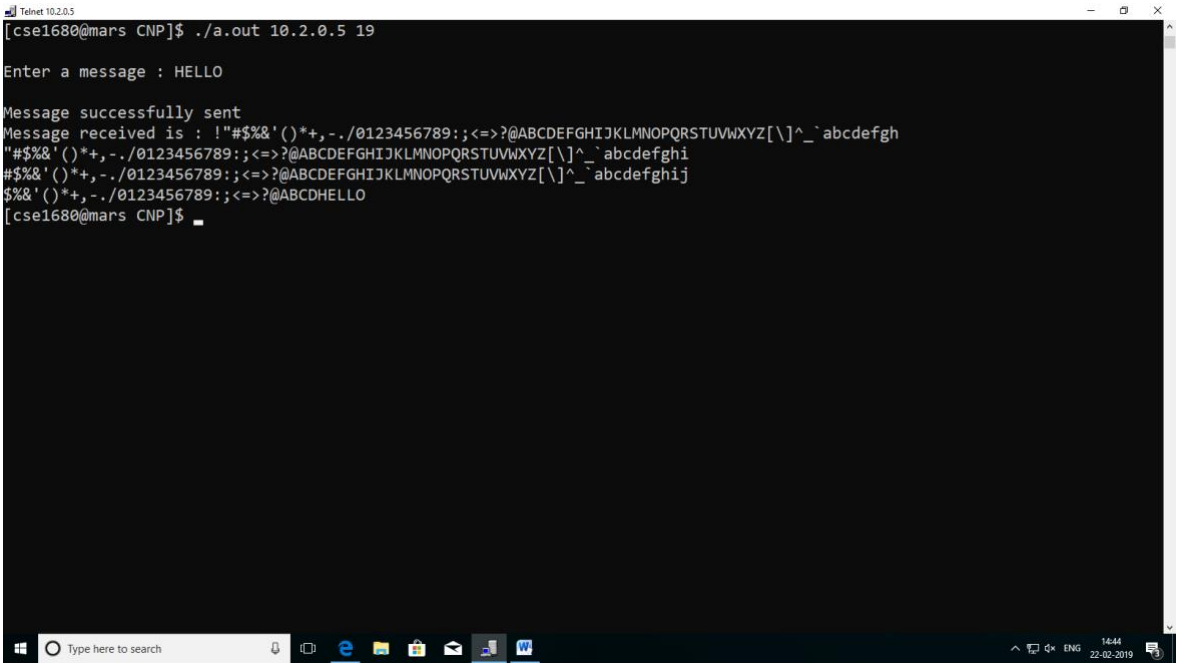


OUTPUT:

compilation : gcc –o cout tcp_client.c

execution : ./cout 10.2.0.5 19 (19 is the port for standard char-gen service)

CLIENT



USER-DEFINED UDP ECHO SERVICE

Program:

/***CLIENT PROGRAM***/

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/socket.h>
#include<netinet/in.h>
#include<sys/types.h>
#include<string.h>
main(int argc,char* argv[])
{
	struct sockaddr_in s,c; //sockets for server and client
	int rval,sockid,slen;
	char m1[20],m2[20];
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP-Address Port#\n",argv[0]);
		exit(1);
	}
	sockid=socket(PF_INET,SOCK_DGRAM,17);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR:");
		exit(1);
	}
	s.sin_family=PF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);
	c.sin_port=htons(5080);

	printf("\nEnter the request message : ");
	scanf("%s",m1);
	slen=sizeof(s);
	rval=sendto(sockid,m1,sizeof(m1),0,(struct sockaddr*)&s,slen);
	if(rval==-1)
```

```
	{
		perror("MSG-SEND-ERR:");
		exit(1);
	}
	printf("\nMessage sent successfully\n");
	strncpy(m2," ",20);
	rval=recvfrom(sockid,m2,sizeof(m2),0,(struct sockaddr*)&s,&slen);
	if(rval==-1)
	{
		perror("MSG-RCV-ERR:");
		exit(1);
	}
	printf("\nMessage received is : %s\n",m2);
	close(sockid);
}
```

/*SERVER PROGRAM*/

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

main(int argc,char* argv[])
{
	int sockid,rval,clen;
	char buffer[20];
	struct sockaddr_in s,c;
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
		exit(0);
	}
	sockid=socket(PF_INET,SOCK_DGRAM,17);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR:");
		exit(1);
```

```
        }
        s.sin_family=PF_INET;
        s.sin_port=htons(atoi(argv[2]));
        s.sin_addr.s_addr=inet_addr(argv[1]);
        rval=bind(sockid,(struct sockaddr*)&s,sizeof(s));
        if(rval==-1)
        {
                perror("BIND-ERR");
                close(sockid);
                exit(1);
        }
        clen=sizeof(c);
        rval=recvfrom(sockid,buffer,sizeof(buffer),0,(struct sockaddr*)&c,&clen);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
        }
        else
        {
                printf("\nRequest received\nRequest message is : %s\n",buffer);
        }
        rval=sendto(sockid,buffer,sizeof(buffer),0,(struct sockaddr*)&c,sizeof(c));
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
        }
        else
        {
                printf("\nResponse sent successfully\n");
        }
        close(sockid);
}
```

OUTPUT:

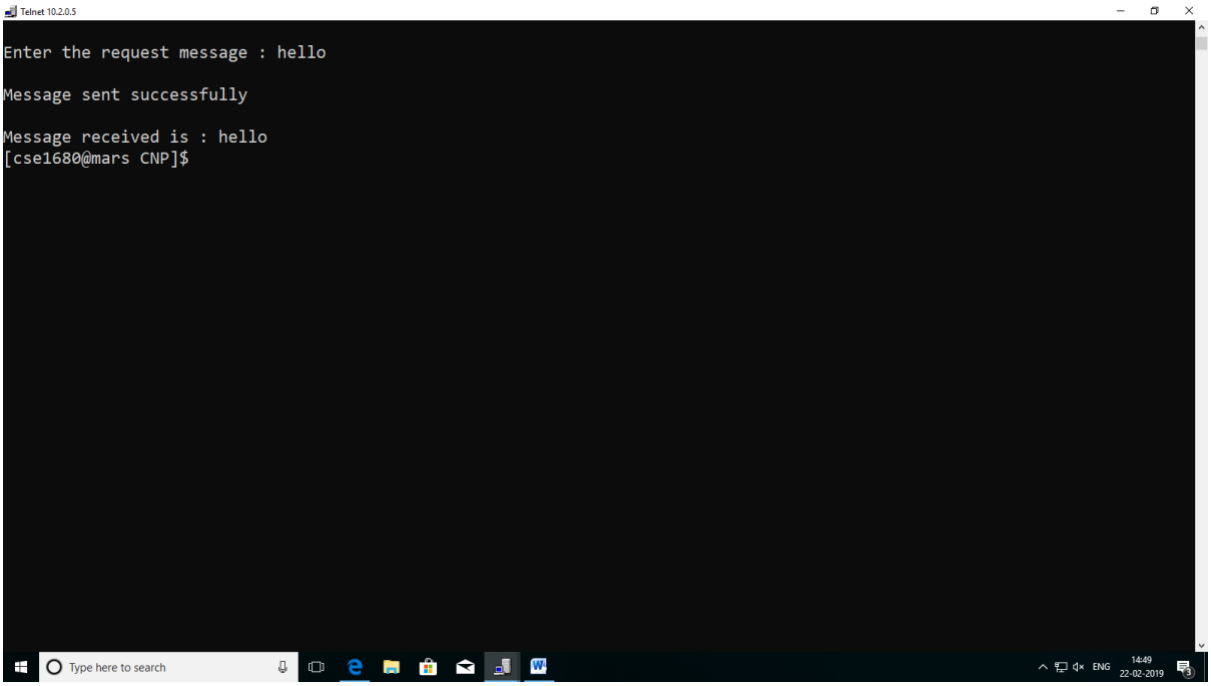
compilation : gcc –o cout udp_client.c

gcc –o sout udp_echosrv.c

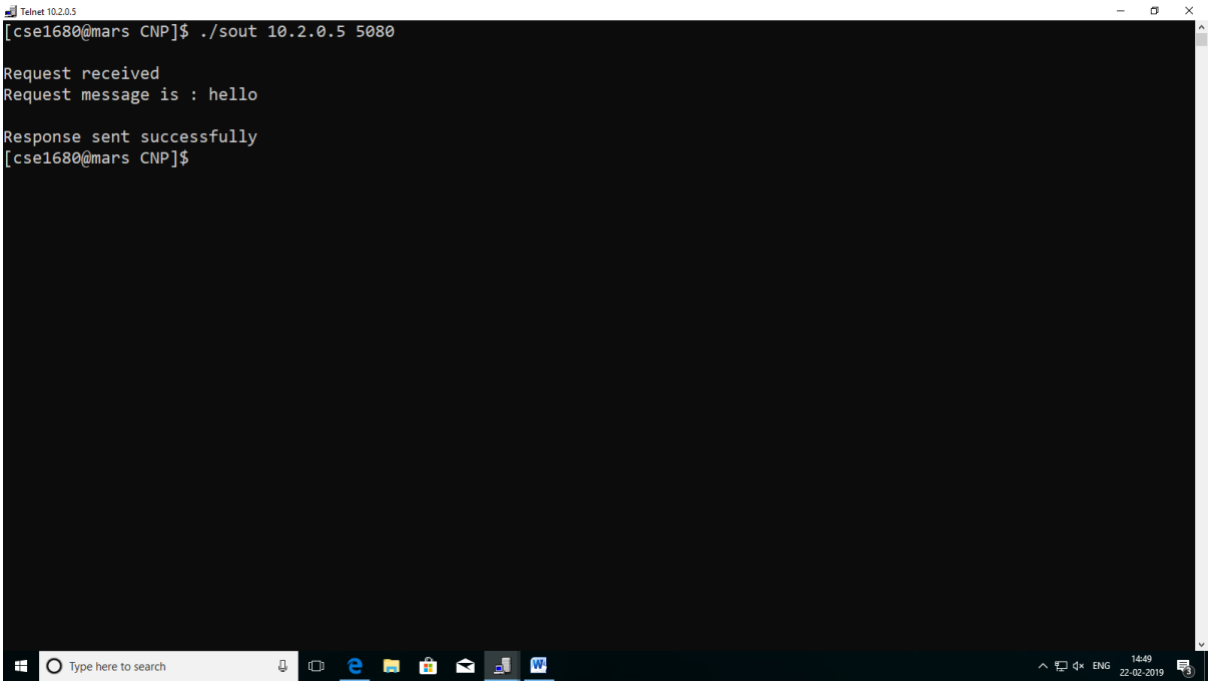
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal)

CLIENT



SERVER



USER-DEFINED UDP DAYTIME SERVICE

Program:

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

main(int argc,char* argv[])
{
	int sockid,rval,clen;
	char buffer[20],smsg[30];
	time_t t;
	struct sockaddr_in s,c;
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
		exit(0);
	}
	sockid=socket(PF_INET,SOCK_DGRAM,17);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR:");
		exit(1);
	}
	s.sin_family=PF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);
	rval=bind(sockid,(struct sockaddr*)&s,sizeof(s));
	if(rval==-1)
	{
		perror("BIND-ERR");
		close(sockid);
		exit(1);
	}
	clen=sizeof(c);
```

```
        rval=recvfrom(sockid,buffer,sizeof(buffer),0,(struct sockaddr*)&c,&clen);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
        }
        else
        {
                printf("\nRequest received\nRequest message is : %s\n",buffer);
        }
        t=time(0);
        strcpy(smsg,ctime(&t));
        rval=sendto(sockid,smsg,sizeof(smsg),0,(struct sockaddr*)&c,sizeof(c));
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
        }
        else
        {
                printf("\nResponse sent successfully\n");
        }
        close(sockid);
}
```

OUTPUT:

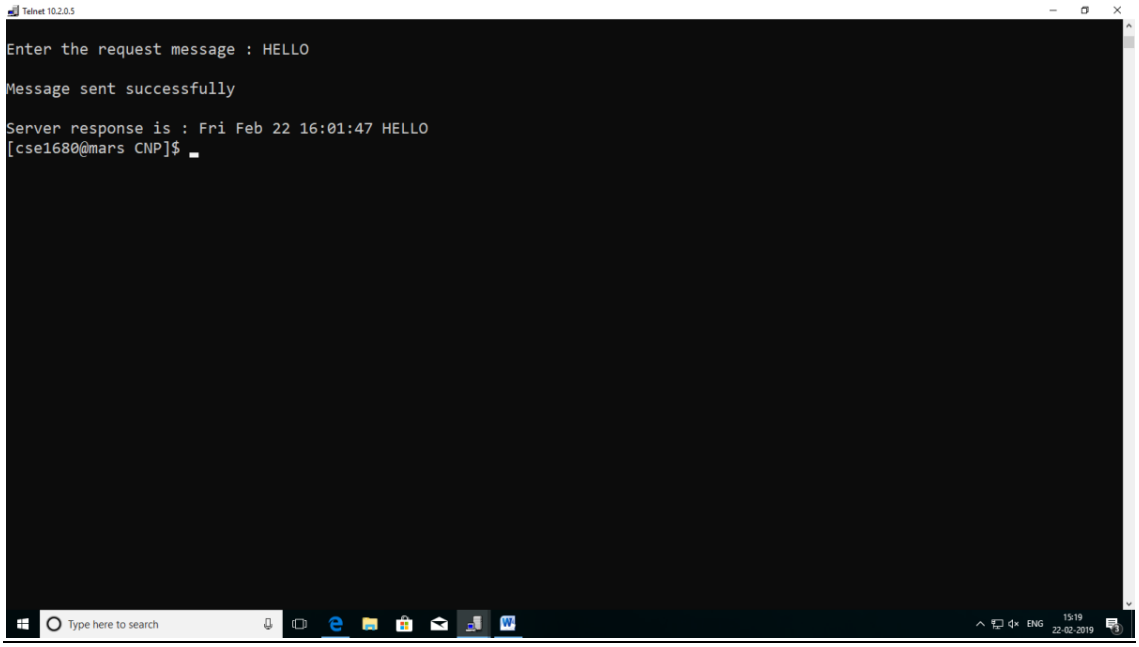
compilation : gcc –o cout udp_client.c

gcc –o sout udp_dts.c

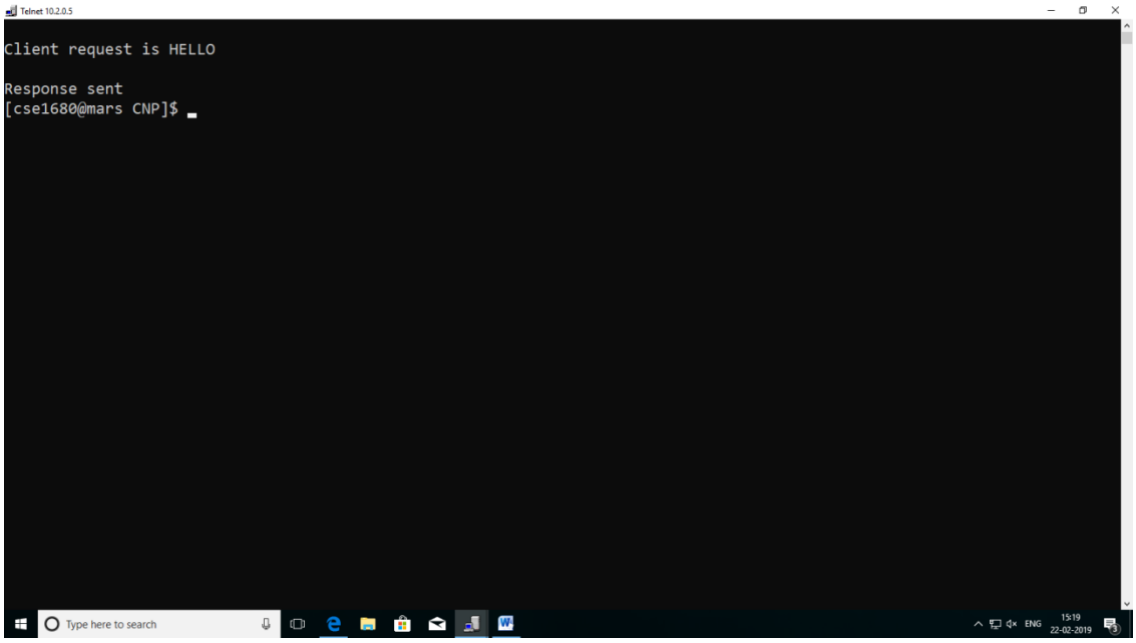
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal)

CLIENT



SERVER



USER-DEFINED TCP ECHO SERVICE

Program:

/***CLIENT PROGRAM***/

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

main(int argc,char* argv[])
{
	int sockid,rval;
	char m1[20],m2[20];
	sockid=socket(AF_INET,SOCK_STREAM,0);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR");
		exit(1);
	}
	struct sockaddr_in s;
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(0);
	}
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	rval=connect(sockid,(struct sockaddr*)&s, sizeof(s));
	if(rval==-1)
	{
		perror("CONN-ERR:");
		close(sockid);
		exit(1);
```

```
        }
        printf("\nEnter the request message : ");
        scanf("%s",m1);
        rval=send(sockid,m1,sizeof(m1),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        rval=recv(sockid,m2,sizeof(m2),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nServer response is : %s\n",m2);
        close(sockid);
}
```

/***SERVER PROGRAM***/

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

main(int argc,char*argv[])
{
        int sid,sid1,rval;// sid is half association. sid1 is full association
        struct sockaddr_in s,c;
        char buffer[20];
        int clen; //accept() uses value-result parameter
        system("clear");
        if(argc<3)
        {
```

```
		printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
		exit(0);
	}
	sid=socket(AF_INET,SOCK_STREAM,6);//3rd parameter can also be 0
	if(sid==-1)
	{
		perror("SOCK-CRE-ERR:");
		exit(1);
	}
	/*DEFINING NAME OF THE SERVICE*/
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	/*BIND SOCKET- indicates the process that is listening*/
	rval=bind(sid,(struct sockaddr*)&s,sizeof(s));
	if(rval==-1)
	{
		perror("BIND-ERR:");
		close(sid);
		exit(1);
	}
	rval=listen(sid,5);//range : 1-5
	if(rval==-1)
	{
		perror("LISTEN-ERR:");
		close(sid);
		exit(1);
	}
	clen=sizeof(c);
	sid1=accept(sid,(struct sockaddr*)&c,&clen);
	//sid1 is a full association tuple and has information of client,server and communication
protocol i.e serving socket
	rval=recv(sid1,buffer,sizeof(buffer),0);
	if(rval==-1)
	{
		perror("MSG-RCV-ERR:");
```

```
        }
        else
        {
                printf("\nClient request is %s\n",buffer);
        }
        rval=send(sid1,buffer,sizeof(buffer),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
        }
        else
        {
                printf("\nResponse sent\n");
        }
        close(sid);
        close(sid1);
}
```

OUTPUT:

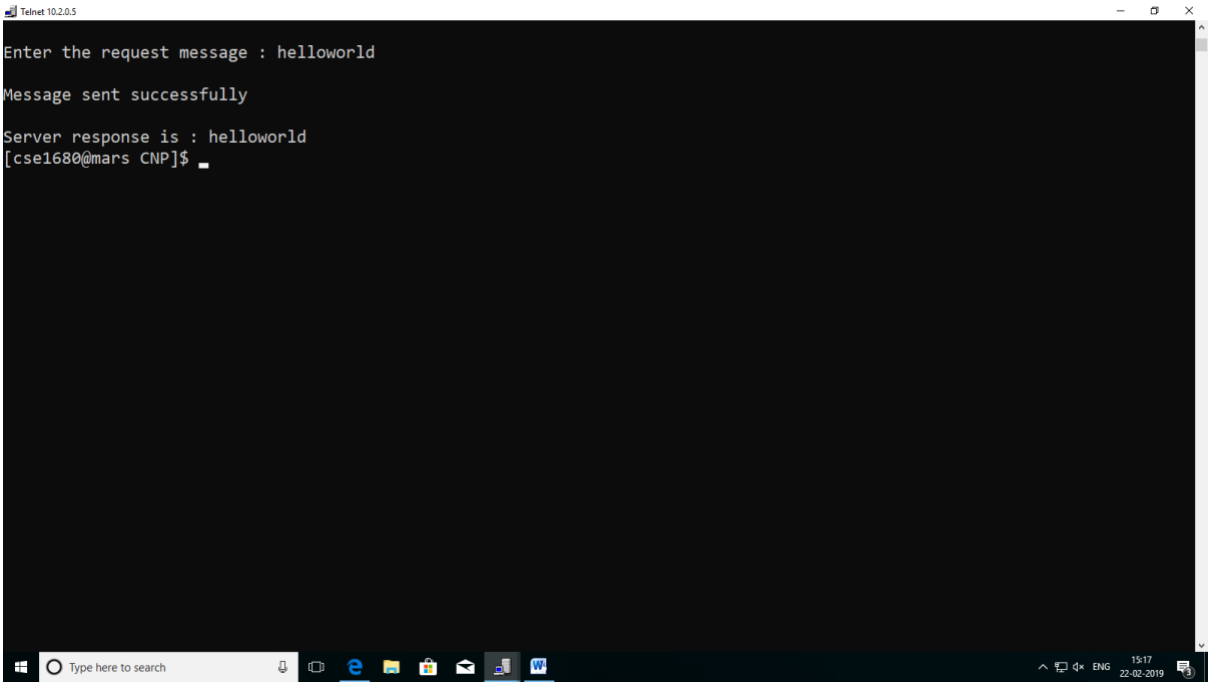
compilation : gcc –o cout tcp_client.c

gcc –o sout tcpserver_echo.c

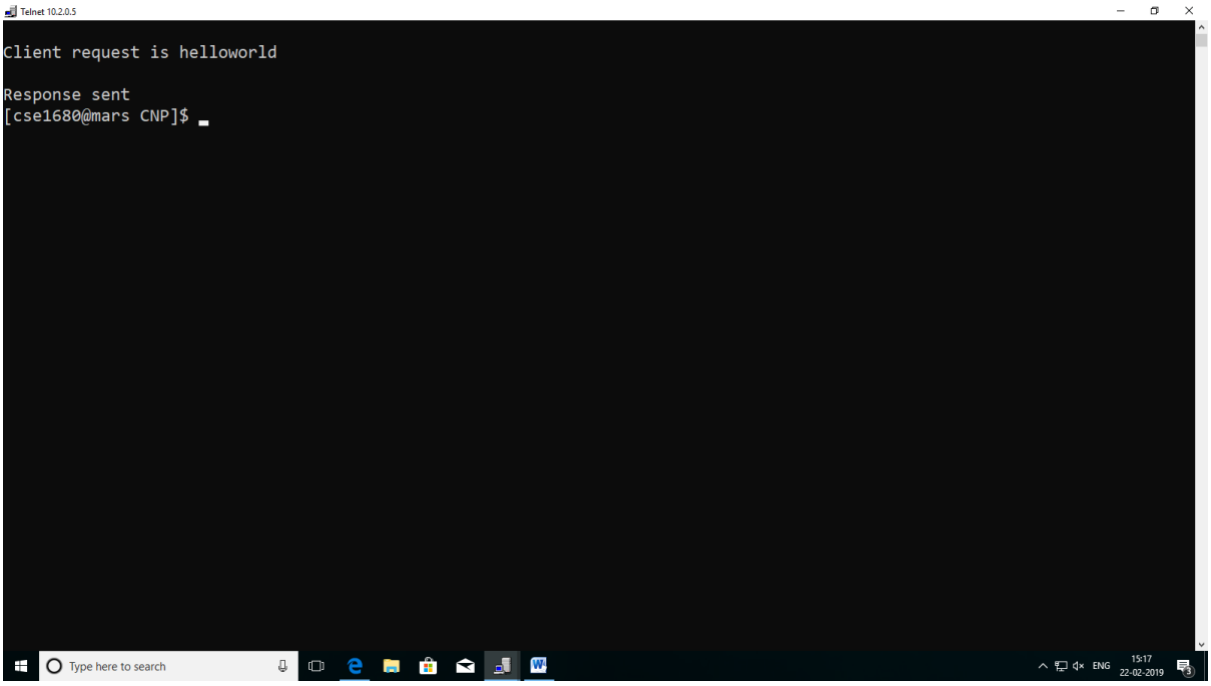
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal)

CLIENT



SERVER



USER-DEFINED TCP DAYTIME SERVICE

Program:

/***CLIENT PROGRAM***/

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

main(int argc,char* argv[])
{
	int sockid,rval;
	char m1[20],m2[20];
	sockid=socket(AF_INET,SOCK_STREAM,0);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR");
		exit(1);
	}
	struct sockaddr_in s;
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(0);
	}
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	rval=connect(sockid,(struct sockaddr*)&s, sizeof(s));
	if(rval==-1)
	{
		perror("CONN-ERR:");
		close(sockid);
		exit(1);
```

```
        }
        printf("\nEnter the request message : ");
        scanf("%s",m1);
        rval=send(sockid,m1,sizeof(m1),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        rval=recv(sockid,m2,sizeof(m2),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nServer response is : %s\n",m2);
        close(sockid);
}
```

/***SERVER PROGRAM***/

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

main(int argc,char*argv[])
{
        int sid,sid1,rval;// sid is half association. sid1 is full association
        time_t t=time(0);
        struct sockaddr_in s,c;
        char buffer[20],smsg[30];
```

```
strcpy(smsg,ctime(&t));
int clen; //accept() uses value-result parameter
system("clear");
if(argc<3)
{
        printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
        exit(0);
}
sid=socket(AF_INET,SOCK_STREAM,6);//3rd parameter can also be 0
if(sid==-1)
{
        perror("SOCK-CRE-ERR:");
        exit(1);
}
/*DEFINING NAME OF THE SERVICE*/
s.sin_family=AF_INET;
s.sin_port=htons(atoi(argv[2]));
s.sin_addr.s_addr=inet_addr(argv[1]);

/*BIND SOCKET- indicates the process that is listening*/
rval=bind(sid,(struct sockaddr*)&s,sizeof(s));
if(rval==-1)
{
        perror("BIND-ERR:");
        close(sid);
        exit(1);
}
rval=listen(sid,5);//range : 1-5
if(rval==-1)
{
        perror("LISTEN-ERR:");
        close(sid);
        exit(1);
}
clen=sizeof(c);
sid1=accept(sid,(struct sockaddr*)&c,&clen);
```

```
	//sid1 is a full association tuple and has information of client,server and communication
protocol i.e serving socket
	rval=recv(sid1,buffer,sizeof(buffer),0);
	if(rval==-1)
	{
		perror("MSG-RCV-ERR:");
	}
	else
	{
		printf("\nClient request is %s\n",buffer);
	}
	strcpy(smsg,ctime(&t));//const time_t* if error
	rval=send(sid1,smsg,sizeof(smsg),0);
	if(rval==-1)
	{
		perror("MSG-SND-ERR:");
	}
	else
	{
		printf("\nResponse sent\n");
	}
	close(sid);
	close(sid1);
}
```

OUTPUT:

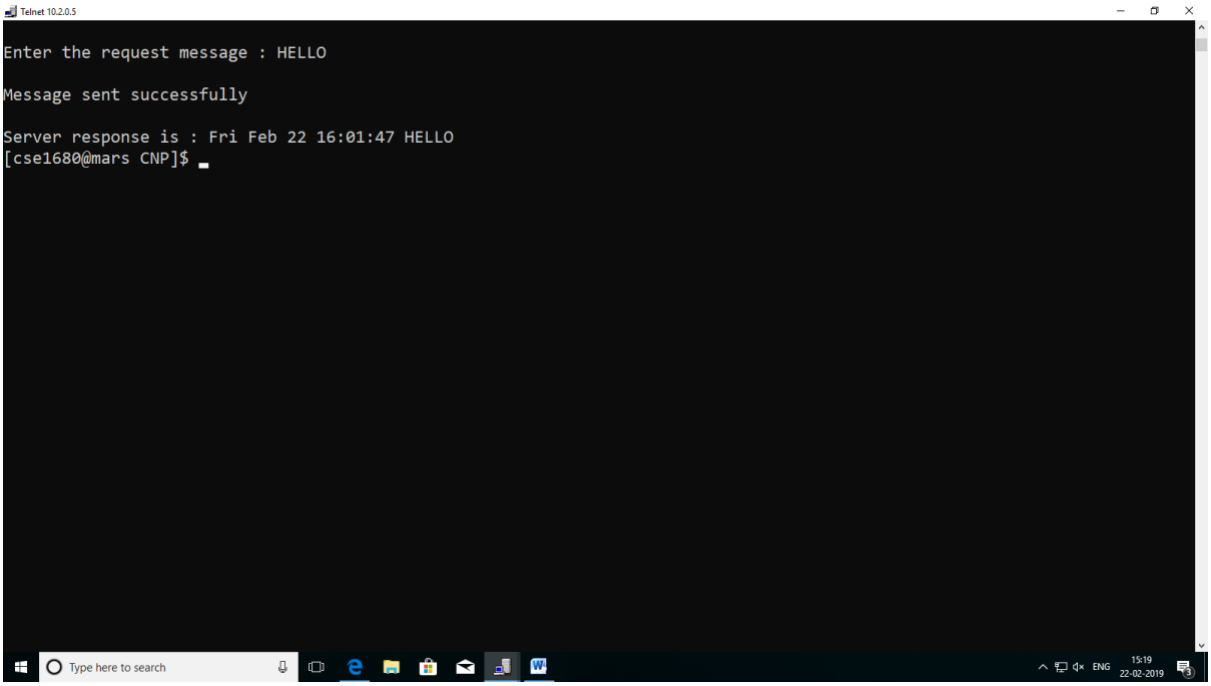
compilation : gcc –o cout tcp_client.c

gcc –o sout tcpserver_dts.c

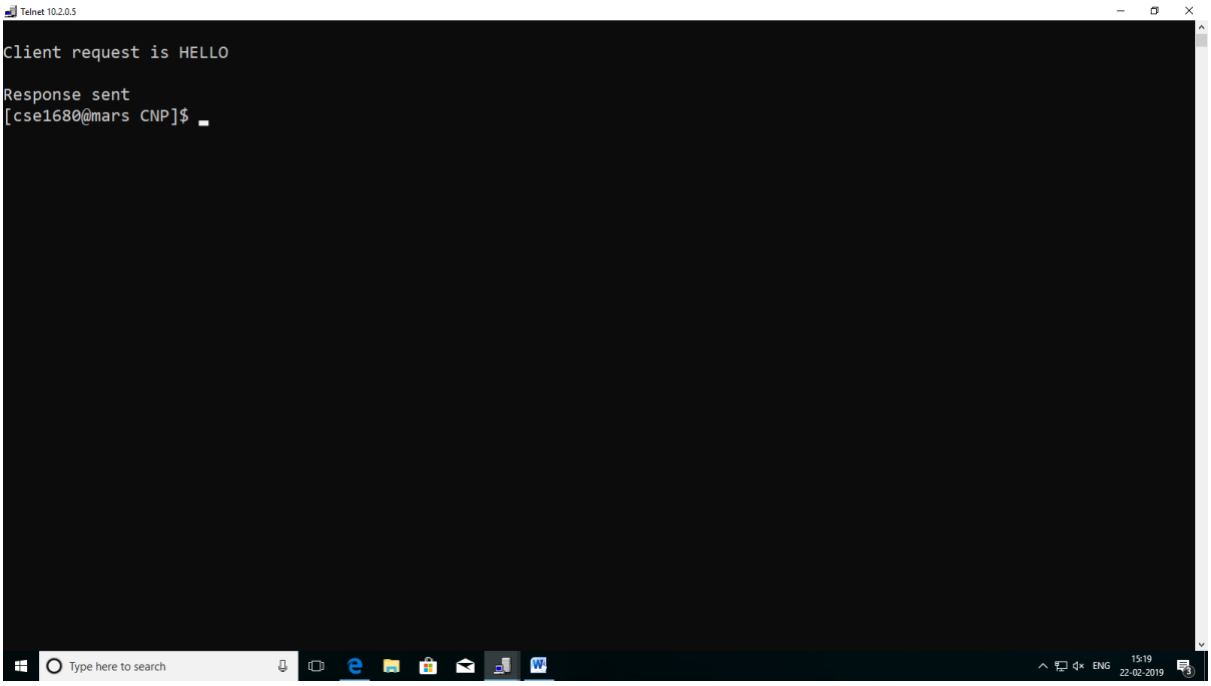
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal)

CLIENT



SERVER



TCP ECHO SERVICE (ITERATIVE)

Program:

/***CLIENT PROGRAM***/

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

main(int argc,char* argv[])
{
	int sockid,rval;
	char m1[20],m2[20];
	sockid=socket(AF_INET,SOCK_STREAM,0);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR");
		exit(1);
	}
	struct sockaddr_in s;
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(0);
	}
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	rval=connect(sockid,(struct sockaddr*)&s, sizeof(s));
	if(rval==-1)
	{
		perror("CONN-ERR:");
		close(sockid);
		exit(1);
```

```
        }
        printf("\nEnter the request message : ");
        scanf("%s",m1);
        rval=send(sockid,m1,sizeof(m1),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        rval=recv(sockid,m2,sizeof(m2),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nServer response is : %s\n",m2);
        close(sockid);
}
```

/***SERVER PROGRAM***/

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

main(int argc,char*argv[])
{
        int sid,sid1,rval,itr,i;// sid is half association. sid1 is full association
        struct sockaddr_in s,c;
        char buffer[20];
        int clen; //accept() uses value-result parameter
        system("clear");
        if(argc<3)
        {
```

```
		printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
		exit(0);
	}
	printf("\nEnter the number of clients to serve/ server iterations : ");
	scanf("%d",&itr);
	sid=socket(AF_INET,SOCK_STREAM,6);//3rd parameter can also be 0
	if(sid==-1)
	{
		perror("SOCK-CRE-ERR:");
		exit(1);
	}
	/*DEFINING NAME OF THE SERVICE*/
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	/*BIND SOCKET- indicates the process that is listening*/
	rval=bind(sid,(struct sockaddr*)&s,sizeof(s));
	if(rval==-1)
	{
		perror("BIND-ERR:");
		close(sid);
		exit(1);
	}
	rval=listen(sid,5);//range : 1-5
	if(rval==-1)
	{
		perror("LISTEN-ERR:");
		close(sid);
		exit(1);
	}
	for(i=1;i<=itr;i++)
	{
		clen=sizeof(c);
		sid1=accept(sid,(struct sockaddr*)&c,&clen);
		//sid1 is a full association tuple and has information of client,server and
communication protocol i.e serving socket
```

```
		rval=recv(sid1,buffer,sizeof(buffer),0);
		if(rval==-1)
		{
			perror("MSG-RCV-ERR:");
		}
		else
		{
			printf("\nClient request is %s\n",buffer);
		}
		rval=send(sid1,buffer,sizeof(buffer),0);
		if(rval==-1)
		{
			perror("MSG-SND-ERR:");
		}
		else
		{
			printf("\nResponse sent\n");
		}
		close(sid1);//closing the serving socket
	}
	close(sid);//closing the listening socket
}
```

OUTPUT:

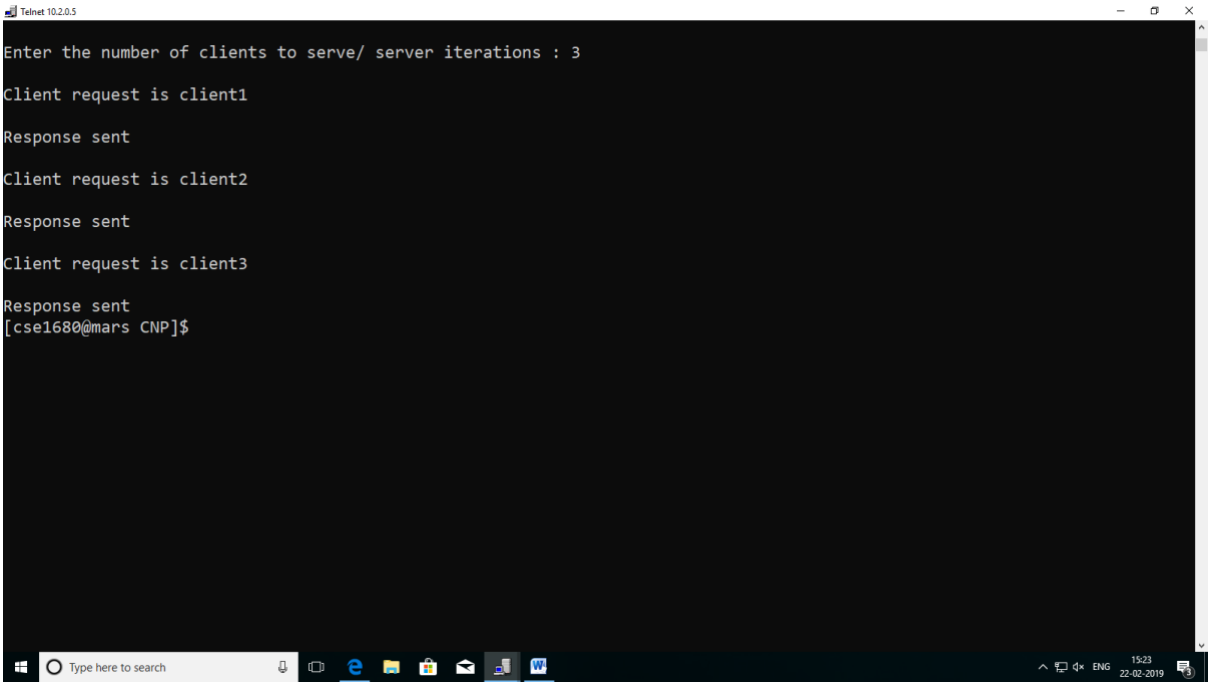
compilation : gcc –o cout tcp_client.c

gcc –o sout tcp_itrsrv_echo.c

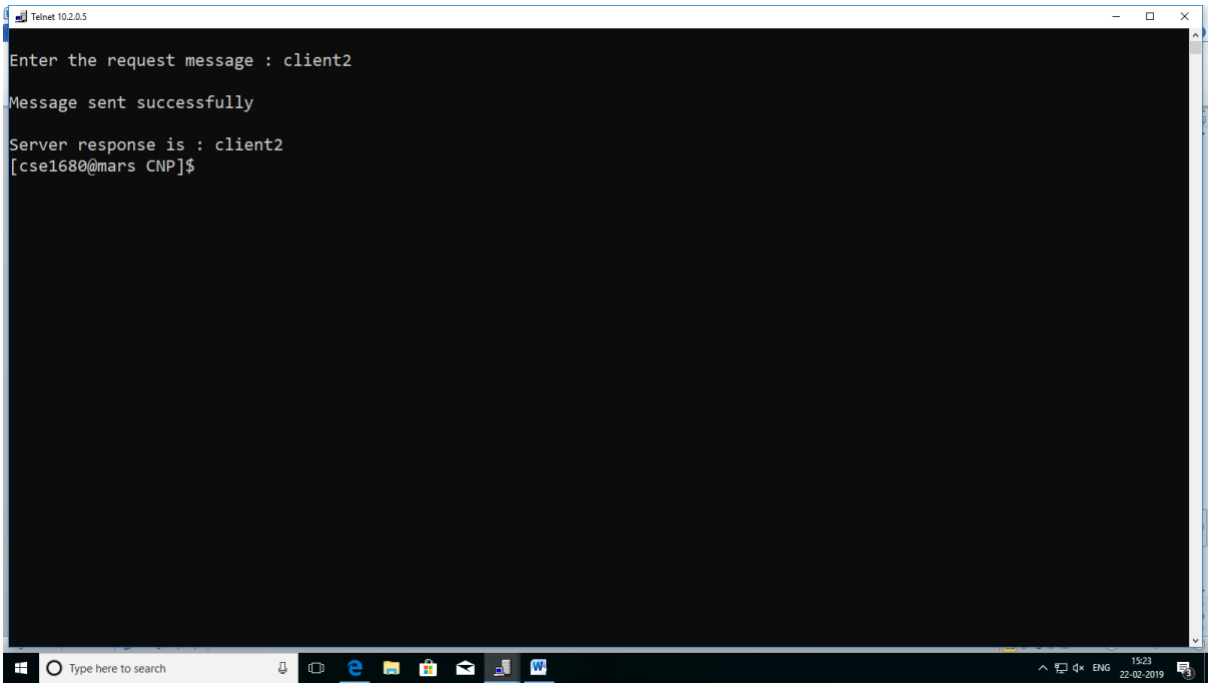
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal) …(for 3 times)

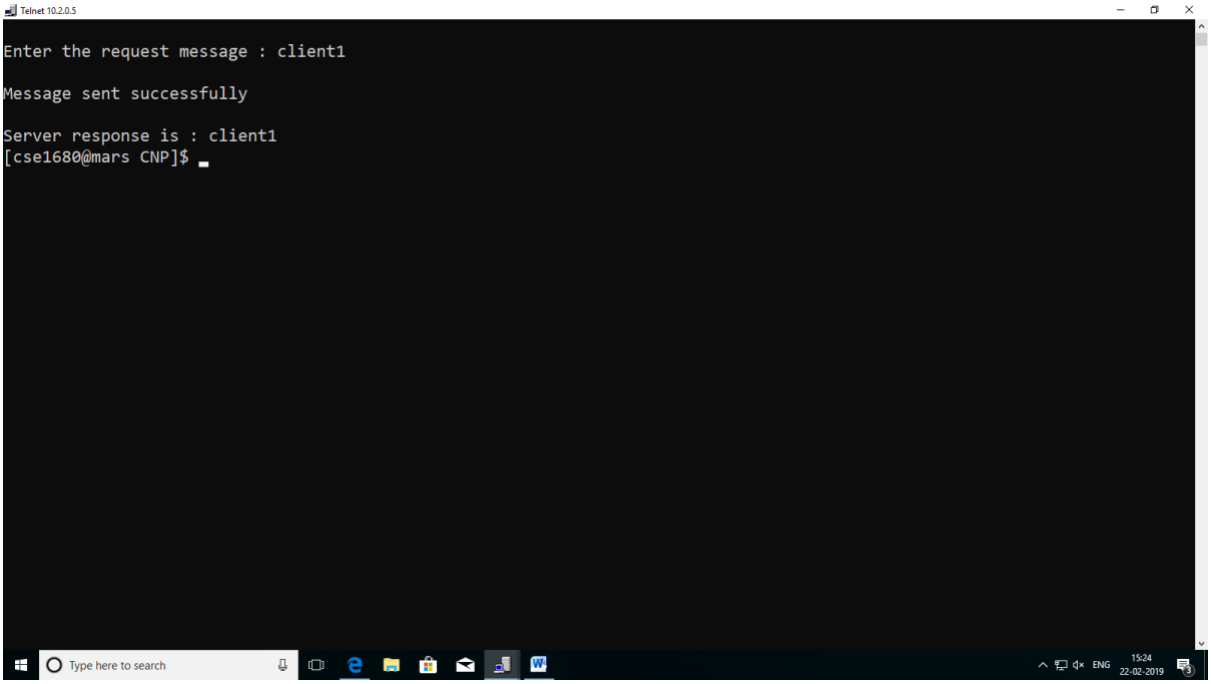
SERVER



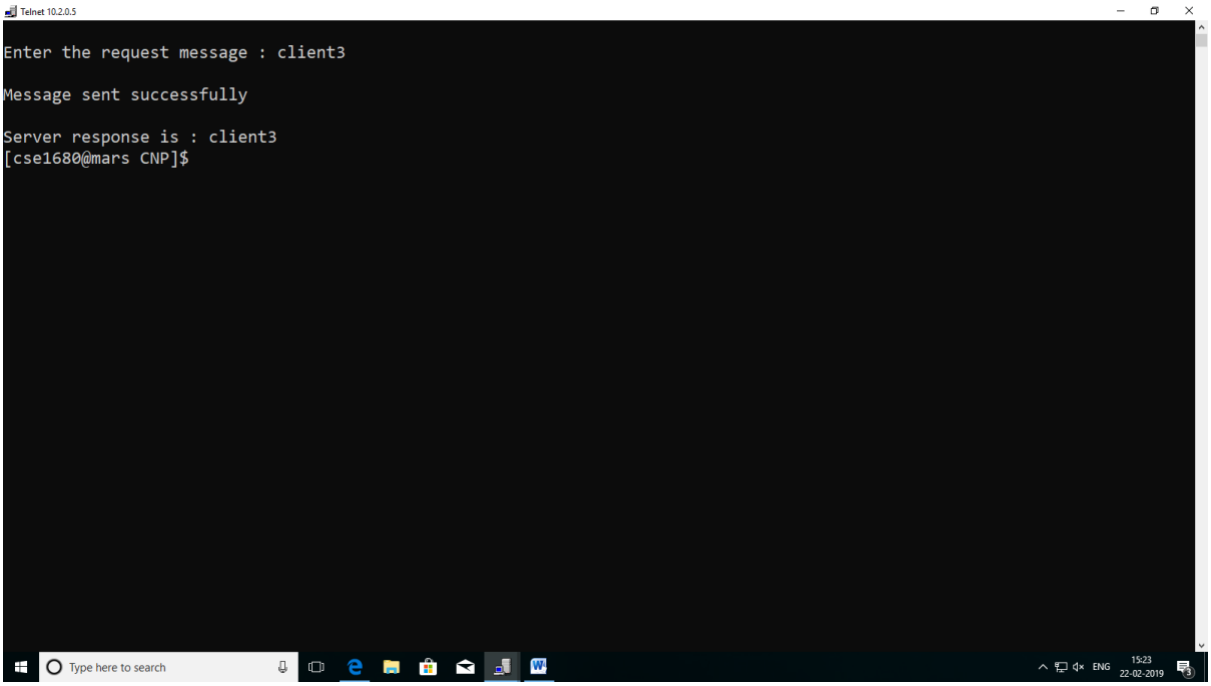
CLIENT 2



CLIENT 1



CLIENT 3



TCP ECHO SERVICE (CONCURRENT)

Program:

/***CLIENT PROGRAM***/

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

main(int argc,char* argv[])
{
	int sockid,rval;
	char m1[20],m2[20];
	sockid=socket(AF_INET,SOCK_STREAM,0);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR");
		exit(1);
	}
	struct sockaddr_in s;
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(0);
	}
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	rval=connect(sockid,(struct sockaddr*)&s, sizeof(s));
	if(rval==-1)
	{
		perror("CONN-ERR:");
		close(sockid);
		exit(1);
```

```
        }
        printf("\nEnter the request message : ");
        scanf("%s",m1);
        rval=send(sockid,m1,sizeof(m1),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        rval=recv(sockid,m2,sizeof(m2),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nServer response is : %s\n",m2);
        close(sockid);
}
```

/***SERVER PROGRAM***/

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

main(int argc,char*argv[])
{
        int sid,sid1,rval,itr,i,pid;// sid is half association. sid1 is full association
        struct sockaddr_in s,c;
        char buffer[20];
        int clen; //accept() uses value-result parameter
        system("clear");
        if(argc<3)
```

```
{
        printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
        exit(0);
}
printf("\nEnter the number of clients to serve/ server iterations : ");
scanf("%d",&itr);
sid=socket(AF_INET,SOCK_STREAM,6);//3rd parameter can also be 0
if(sid==-1)
{
        perror("SOCK-CRE-ERR:");
        exit(1);
}
/*DEFINING NAME OF THE SERVICE*/
s.sin_family=AF_INET;
s.sin_port=htons(atoi(argv[2]));
s.sin_addr.s_addr=inet_addr(argv[1]);

/*BIND SOCKET- indicates the process that is listening*/
rval=bind(sid,(struct sockaddr*)&s,sizeof(s));
if(rval==-1)
{
        perror("BIND-ERR:");
        close(sid);
        exit(1);
}
rval=listen(sid,5);//range : 1-5
if(rval==-1)
{
        perror("LISTEN-ERR:");
        close(sid);
        exit(1);
}
for(i=1;i<=itr;i++)
{
        clen=sizeof(c);
        sid1=accept(sid,(struct sockaddr*)&c,&clen);
        if(sid1==-1)
```

```
{
        perror("ACCEPT-ERR:");
        close(sid);
        exit(1);
}
pid=fork();
if(pid==-1)
{
        perror("FRK-ERR:");
        close(sid1);
        close(sid);
        exit(1);
}

//sid1 is a full association tuple and has information of client,server and
communication protocol i.e serving socket

if(pid==0) //CHILD
{
        rval=recv(sid1,buffer,sizeof(buffer),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
        }
        else
        {
                printf("\nClient request is %s\n",buffer);
        }
        rval=send(sid1,buffer,sizeof(buffer),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
        }
        else
        {
                printf("\nResponse sent\n");
        }
```

```
                close(sid1);//closing the serving socket
                exit(0);
        }
        else  //PARENT
                close(sid1);//parent also has a copy of the serving socket. So close it
here.
    }
    close(sid);//closing the listening socket
    exit(0);
}
```

OUTPUT:

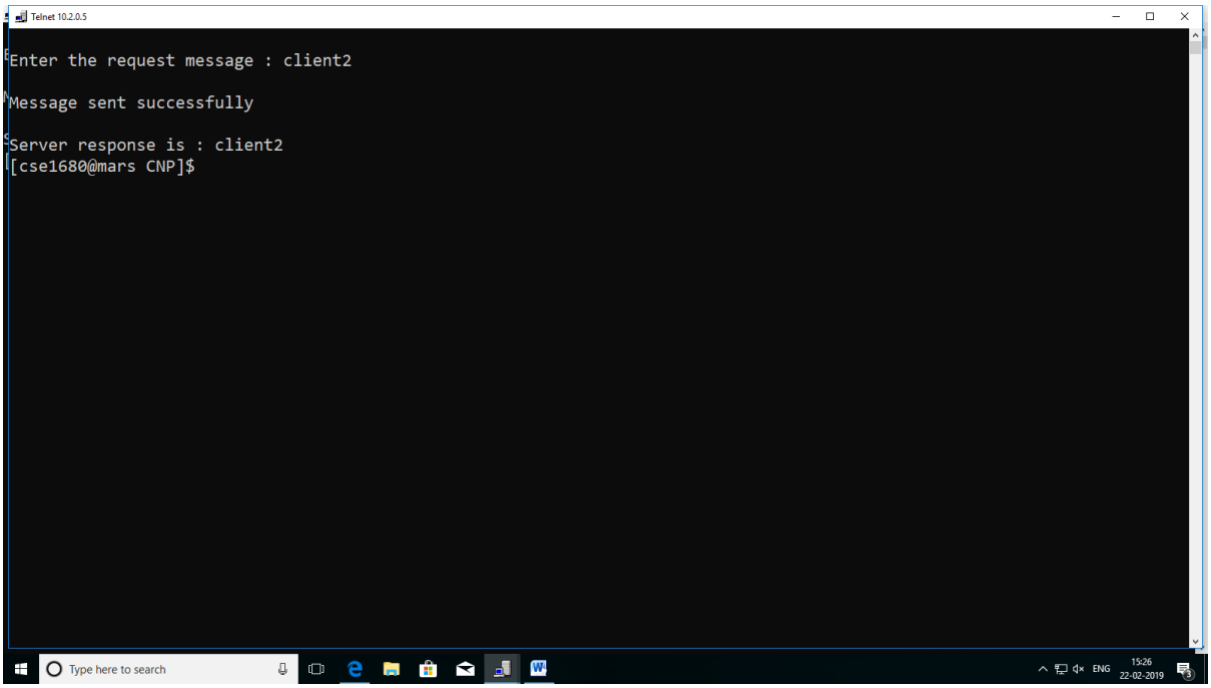
compilation : gcc –o cout tcp_client.c

gcc –o sout tcp_con_ES.c

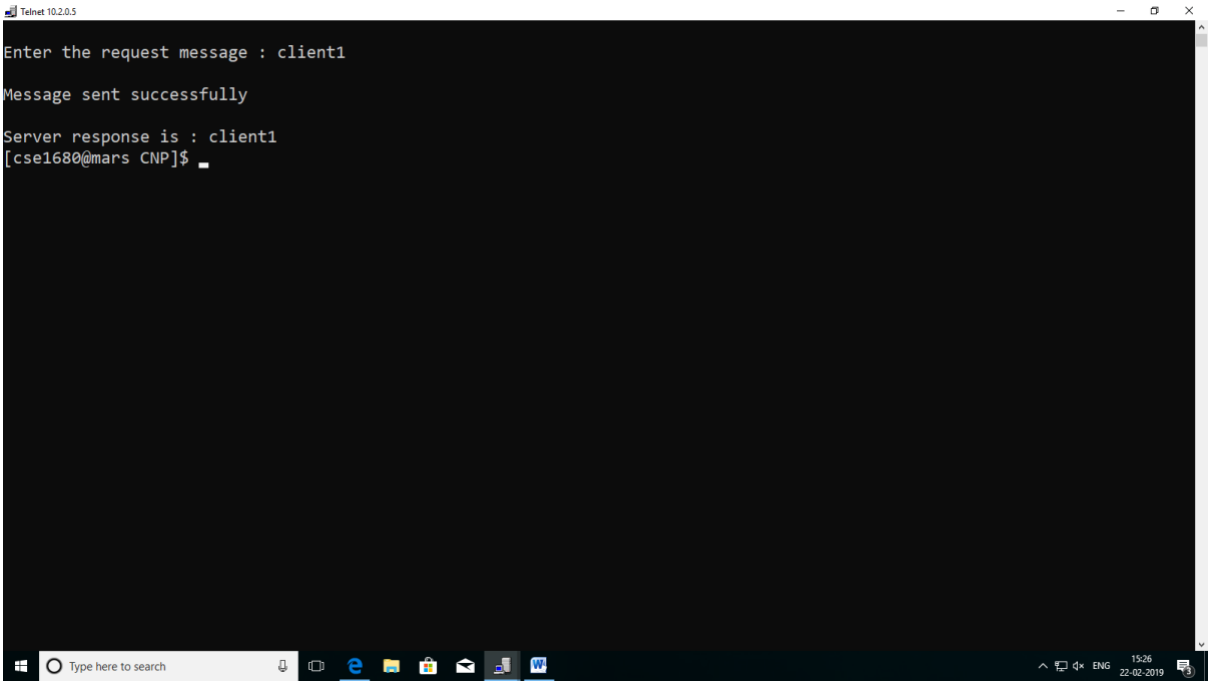
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal) …(for 3 times)

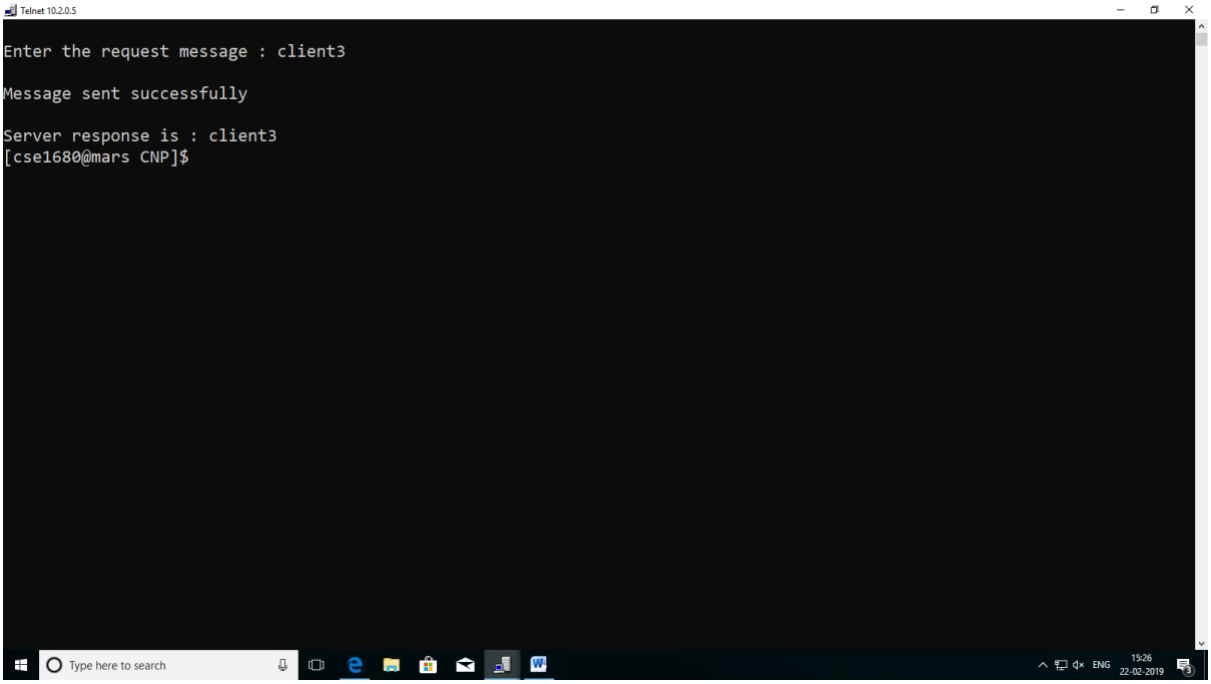
CLIENT 2



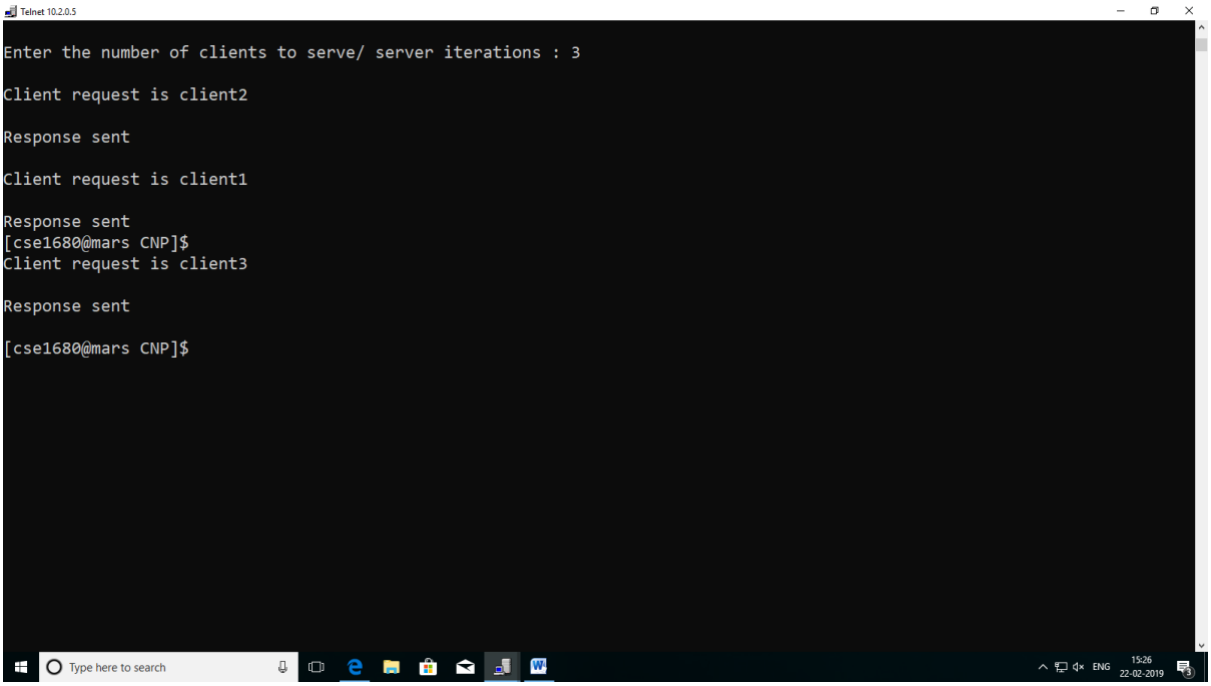
CLIENT 1



CLIENT 3



SERVER



TCP DAYTIME SERVICE (ITERATIVE)

Program:

/***CLIENT PROGRAM***/

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

main(int argc,char* argv[])
{
	int sockid,rval;
	char m1[20],m2[20];
	sockid=socket(AF_INET,SOCK_STREAM,0);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR");
		exit(1);
	}
	struct sockaddr_in s;
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(0);
	}
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	rval=connect(sockid,(struct sockaddr*)&s, sizeof(s));
	if(rval==-1)
	{
		perror("CONN-ERR:");
		close(sockid);
		exit(1);
```

```
        }
        printf("\nEnter the request message : ");
        scanf("%s",m1);
        rval=send(sockid,m1,sizeof(m1),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        rval=recv(sockid,m2,sizeof(m2),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nServer response is : %s\n",m2);
        close(sockid);
}
```

/***SERVER PROGRAM***/

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

main(int argc,char*argv[])
{
        int sid,sid1,rval,itr,i;// sid is half association. sid1 is full association
        struct sockaddr_in s,c;
        char buffer[20],smsg[30];
        time_t t;
        int clen; //accept() uses value-result parameter
        system("clear");
        if(argc<3)
```

```
{
        printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
        exit(0);
}
printf("\nEnter the number of clients to serve/ server iterations : ");
scanf("%d",&itr);
sid=socket(AF_INET,SOCK_STREAM,6);//3rd parameter can also be 0
if(sid==-1)
{
        perror("SOCK-CRE-ERR:");
        exit(1);
}
/*DEFINING NAME OF THE SERVICE*/
s.sin_family=AF_INET;
s.sin_port=htons(atoi(argv[2]));
s.sin_addr.s_addr=inet_addr(argv[1]);

/*BIND SOCKET- indicates the process that is listening*/
rval=bind(sid,(struct sockaddr*)&s,sizeof(s));
if(rval==-1)
{
        perror("BIND-ERR:");
        close(sid);
        exit(1);
}
rval=listen(sid,5);//range : 1-5
if(rval==-1)
{
        perror("LISTEN-ERR:");
        close(sid);
        exit(1);
}
for(i=1;i<=itr;i++)
{
        clen=sizeof(c);
        sid1=accept(sid,(struct sockaddr*)&c,&clen);
```

```
		//sid1 is a full association tuple and has information of client,server and
communication protocol i.e serving socket
		rval=recv(sid1,buffer,sizeof(buffer),0);
		if(rval==-1)
		{
			perror("MSG-RCV-ERR:");
		}
		else
		{
			printf("\nClient request is %s\n",buffer);
		}
		t=time(0);
		strcpy(smsg,ctime(&t));
		rval=send(sid1,smsg,sizeof(smsg),0);
		if(rval==-1)
		{
			perror("MSG-SND-ERR:");
		}
		else
		{
			printf("\nResponse sent\n");
		}
		close(sid1);//closing the serving socket
	}
	close(sid);//closing the listening socket
}
```

OUTPUT:

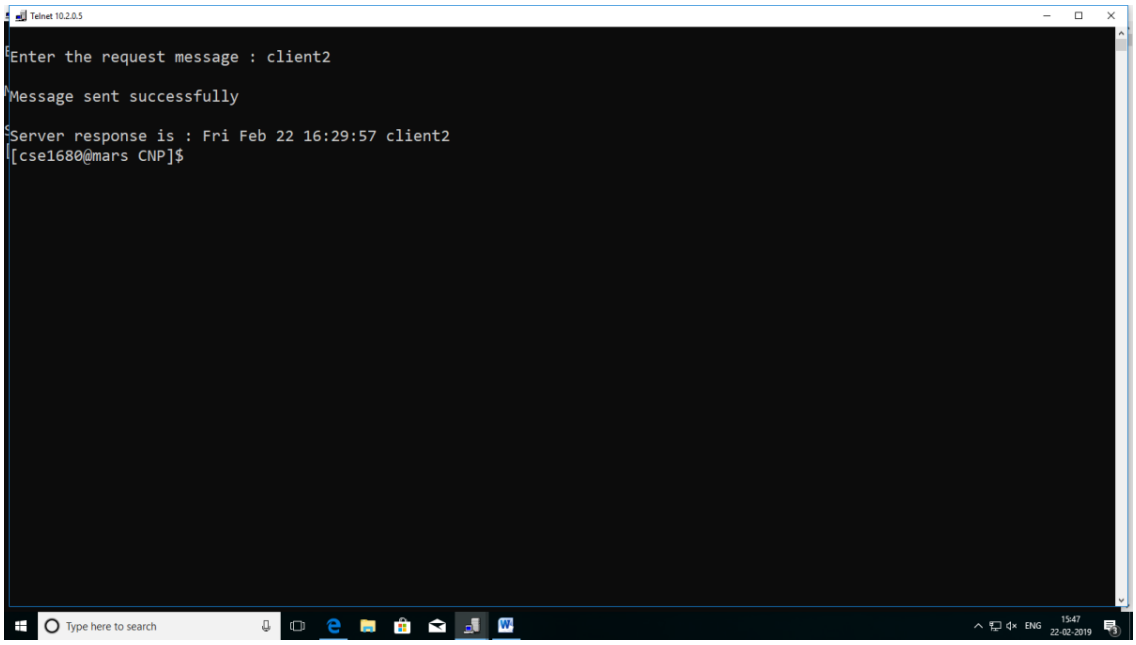
compilation : gcc –o cout tcp_client.c

gcc –o sout tcp_itrsrv_dts.c

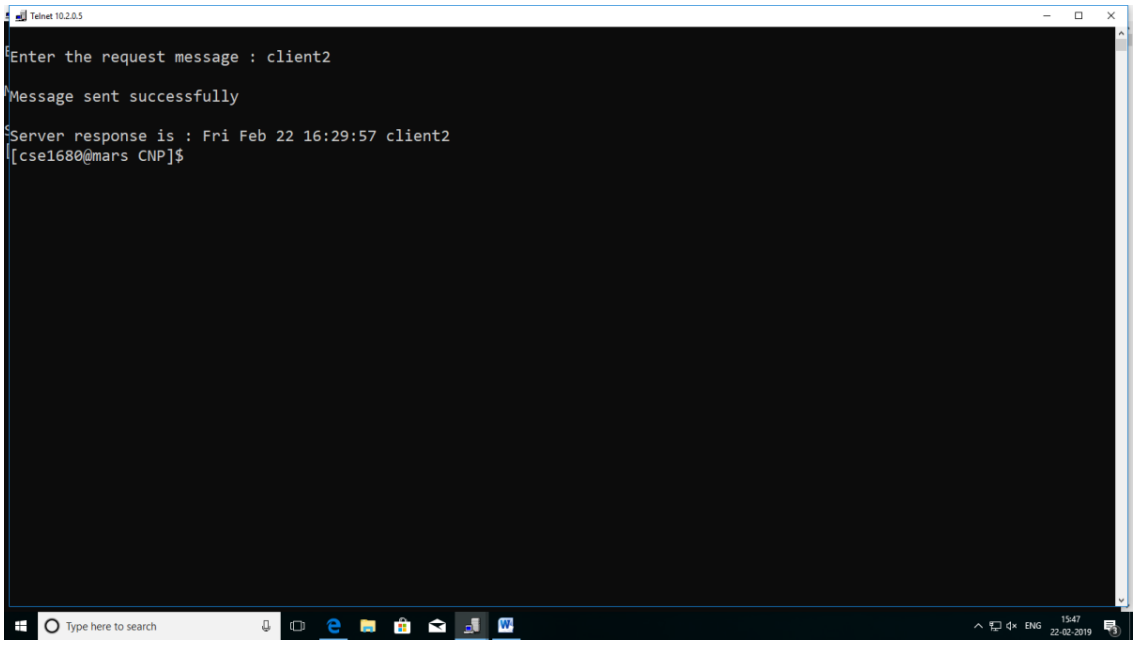
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal) …(for 3 times)

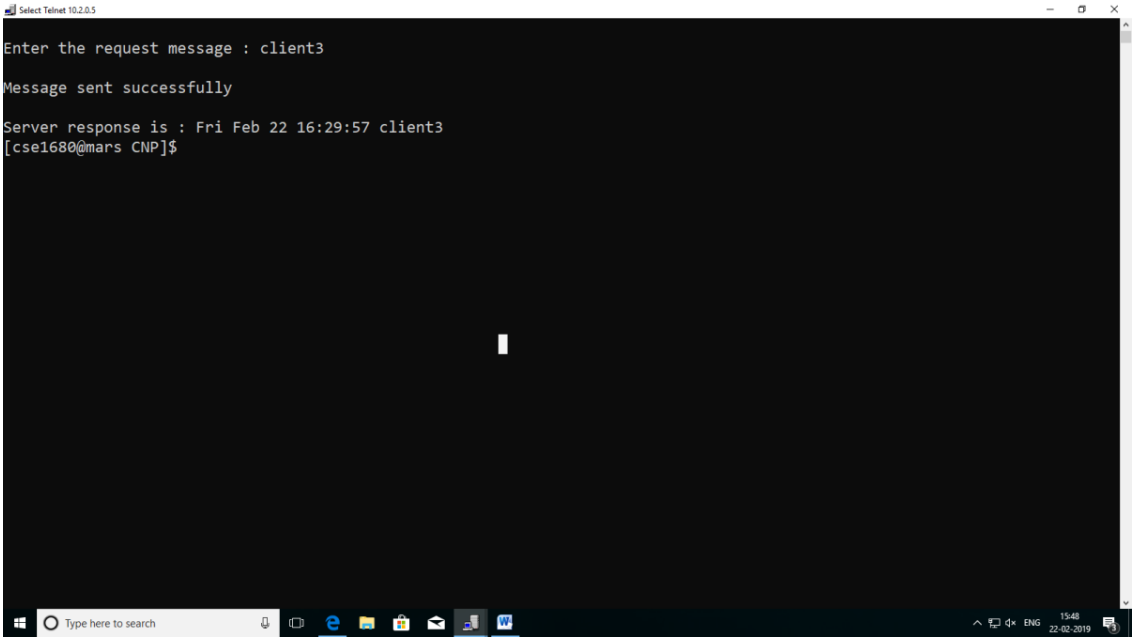
CLIENT 1



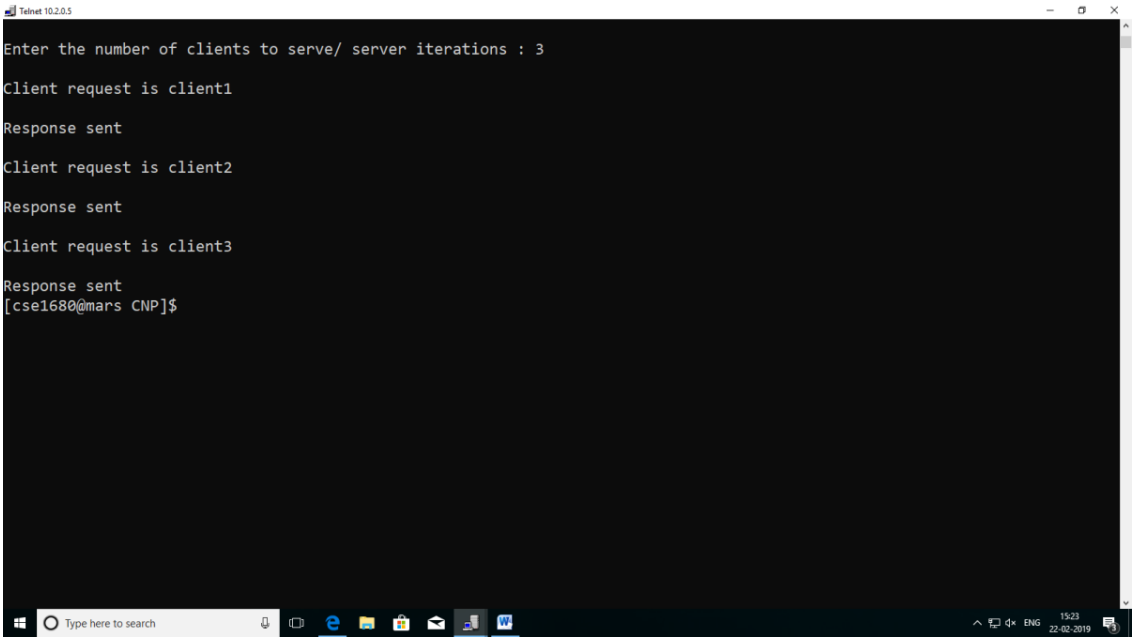
CLIENT 2



CLIENT 3



SERVER



TCP DAYTIME SERVICE (CONCURRENT)

Program:

/***CLIENT PROGRAM***/

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

main(int argc,char* argv[])
{
	int sockid,rval;
	char m1[20],m2[20];
	sockid=socket(AF_INET,SOCK_STREAM,0);
	if(sockid==-1)
	{
		perror("SOCK-CRE-ERR");
		exit(1);
	}
	struct sockaddr_in s;
	system("clear");
	if(argc<3)
	{
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(0);
	}
	s.sin_family=AF_INET;
	s.sin_port=htons(atoi(argv[2]));
	s.sin_addr.s_addr=inet_addr(argv[1]);

	rval=connect(sockid,(struct sockaddr*)&s, sizeof(s));
	if(rval==-1)
	{
		perror("CONN-ERR:");
		close(sockid);
		exit(1);
```

```
        }
        printf("\nEnter the request message : ");
        scanf("%s",m1);
        rval=send(sockid,m1,sizeof(m1),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nMessage sent successfully\n");
        rval=recv(sockid,m2,sizeof(m2),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nServer response is : %s\n",m2);
        close(sockid);
}
```

/***SERVER PROGRAM***/

```
#include<stdio.h>
#include<unistd.h>
#include<stdlib.h>
#include<string.h>
#include<sys/types.h>
#include<sys/socket.h>
#include<netinet/in.h>
#include<time.h>
main(int argc,char*argv[])
{
        int sid,sid1,rval,itr,i,pid;// sid is half association. sid1 is full association
        struct sockaddr_in s,c;
        char buffer[20],smsg[30];
        time_t t=time(0);
```

```
int clen; //accept() uses value-result parameter
system("clear");
if(argc<3)
{
        printf("\nUSAGE : %s IP_ADDRESS PORT#\n",argv[0]);
        exit(0);
}
printf("\nEnter the number of clients to serve/ server iterations : ");
scanf("%d",&itr);
sid=socket(AF_INET,SOCK_STREAM,6);//3rd parameter can also be 0
if(sid==-1)
{
        perror("SOCK-CRE-ERR:");
        exit(1);
}
/*DEFINING NAME OF THE SERVICE*/
s.sin_family=AF_INET;
s.sin_port=htons(atoi(argv[2]));
s.sin_addr.s_addr=inet_addr(argv[1]);

/*BIND SOCKET- indicates the process that is listening*/
rval=bind(sid,(struct sockaddr*)&s,sizeof(s));
if(rval==-1)
{
        perror("BIND-ERR:");
        close(sid);
        exit(1);
}
rval=listen(sid,5);//range : 1-5
if(rval==-1)
{
        perror("LISTEN-ERR:");
        close(sid);
        exit(1);
}
for(i=1;i<=itr;i++)
{
```

```
clen=sizeof(c);
sid1=accept(sid,(struct sockaddr*)&c,&clen);
if(sid1==-1)
{
        perror("ACCEPT-ERR:");
        close(sid);
        exit(1);
}
pid=fork();
if(pid==-1)
{
        perror("FRK-ERR:");
        close(sid1);
        close(sid);
        exit(1);
}

//sid1 is a full association tuple and has information of client,server and
communication protocol i.e serving socket

if(pid==0) //CHILD
{
        rval=recv(sid1,buffer,sizeof(buffer),0);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
        }
        else
        {
                printf("\nClient request is %s\n",buffer);
        }
        strcpy(smsg,ctime(&t));
        rval=send(sid1,smsg,sizeof(smsg),0);
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
        }
```

```
                    else
                    {
                        printf("\nResponse sent\n");
                    }
                    close(sid1);//closing the serving socket
                    exit(0);
                }
                else  //PARENT
                    close(sid1);//parent also has a copy of the serving socket. So close it
here.
        }
        close(sid);//closing the listening socket
        exit(0);
}
```

OUTPUT:

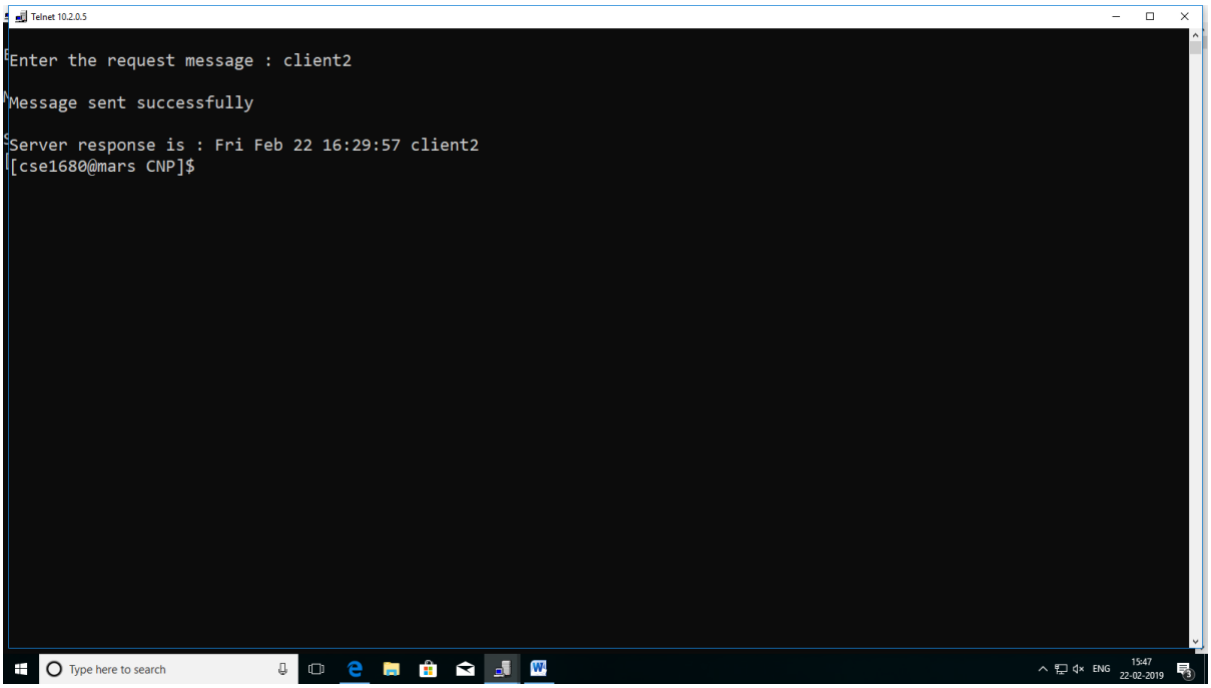
compilation : gcc –o cout tcp_client.c

gcc –o sout tcp_con_ES_dts.c

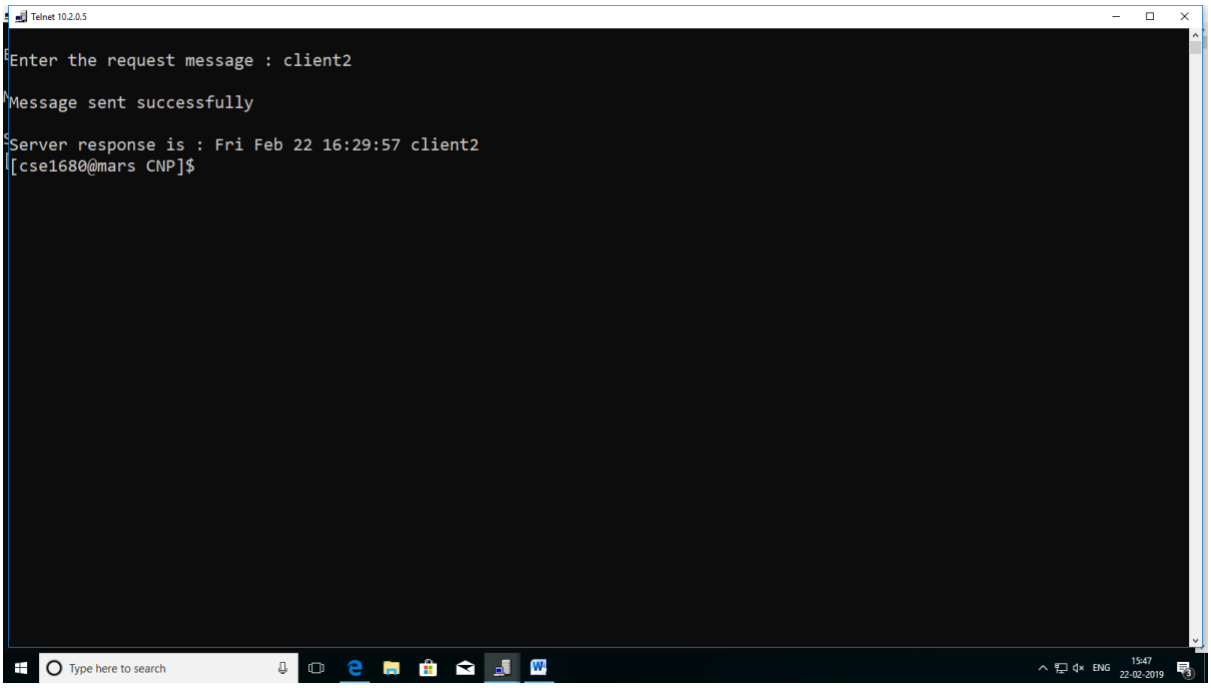
execution : ./sout 10.2.0.5 5080 (server terminal)

./cout 10.2.0.5 5080 (client terminal) …(for 3 times)

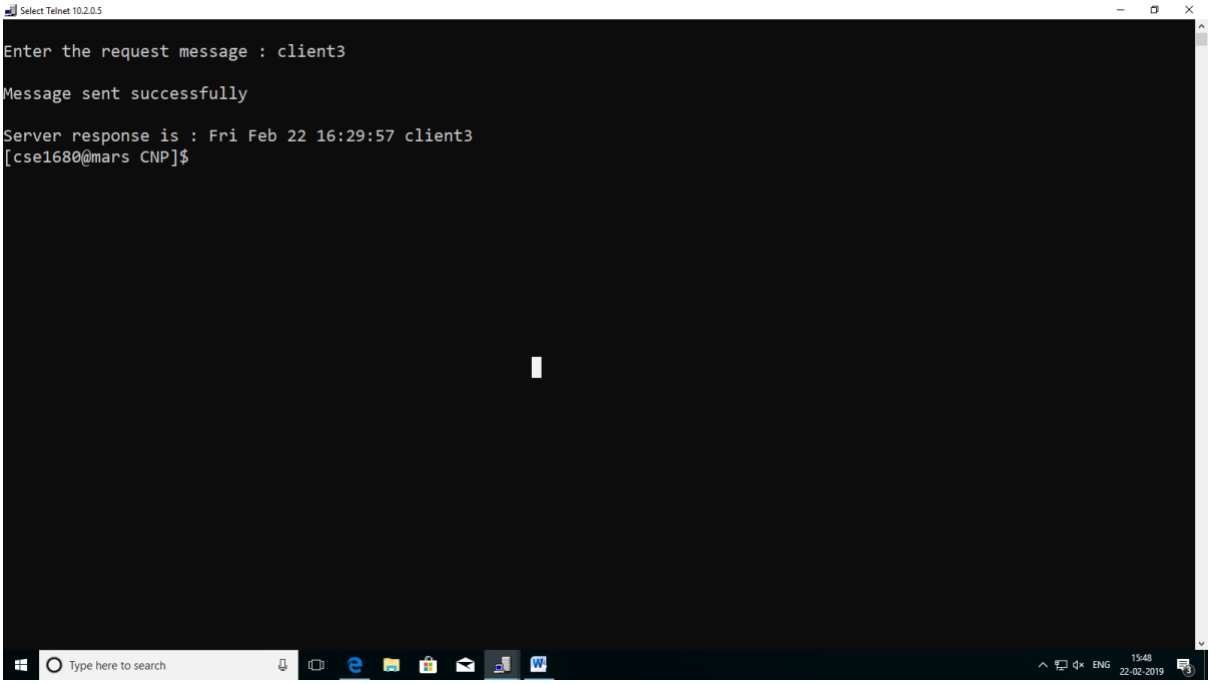
CLIENT 2



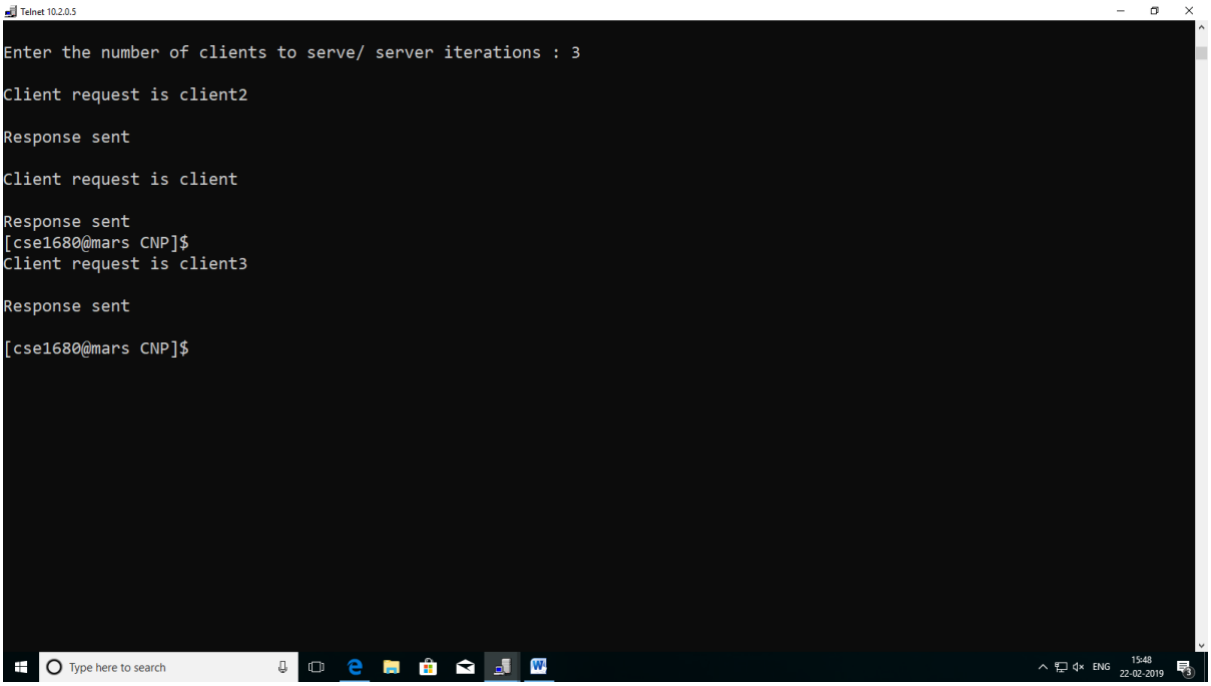
CLIENT 1



CLIENT 3



SERVER



BASIC OPERATIONS ON SEMAPHORES

Program:

```
#include<stdio.h>

#include<stdlib.h>

#include<sys/types.h>

#include<semaphore.h>

#include<sys/shm.h>

#include<sys/ipc.h>


main(int argc,char* argv[])

{

        int shmid,rval,sval,csval;

        sem_t *sem_phore;

        system("clear");

        if(argc<3)

        {

                printf("\nUSAGE : %s labelForSHM ByteSize\n",argv[0]);

                exit(0);

        }

        shmid=shmget((key_t)atoi(argv[1]),atoi(argv[2]),IPC_CREAT|0666);

        if(shmid==-1)

        {

                perror("SHM-CRE-ERR:");

                exit(1);

        }

        sem_phore=(sem_t*)shmat(shmid,0,0);

        if(!sem_phore)

        {
```

```
        perror("SHM-ATT-ERR:");
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
printf("\nEnter the initial value for the semaphore: ");
scanf("%d",&sval);
/*INITIALIZE VALUE OF SEMAPHORE*/
rval=sem_init(sem_phore,1,sval);
if(rval==-1)
{
        perror("Unable to initialize semaphore:");
        shmdt(sem_phore);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
rval=sem_getvalue(sem_phore,&csval);//sem_phore gets the value in csval
if(rval==-1)
{
        perror("Unable to get value of the semaphore: ");
        shmdt(sem_phore);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
printf("\nInitialized value of semaphore is %d\n",csval);
//EXECUTE WAIT OPERATION
rval=sem_wait(sem_phore);
if(rval==-1)
{
```

```
		perror("WAIT-FAILURE:");
		shmdt(sem_phore);
		shmctl(shmid,IPC_RMID,0);
		exit(1);
	}
	rval=sem_getvalue(sem_phore,&csval);
	if(rval==-1)
	{
		perror("Unable to get semaphore value:");
		shmdt(sem_phore);
		shmctl(shmid,IPC_RMID,0);
		exit(1);
	}
	printf("\nSemaphore value after wait is %d\n",csval);
	//EXECUTE SIGNAL OPERATION
	rval=sem_post(sem_phore);
	if(rval==-1)
	{
		perror("Unable to get semaphore value:");
		shmdt(sem_phore);
		shmctl(shmid,IPC_RMID,0);
		exit(1);
	}
	rval=sem_getvalue(sem_phore,&csval);
	if(rval==-1)
	{
		perror("Unable to get semaphore value: ");
		shmdt(sem_phore);
```

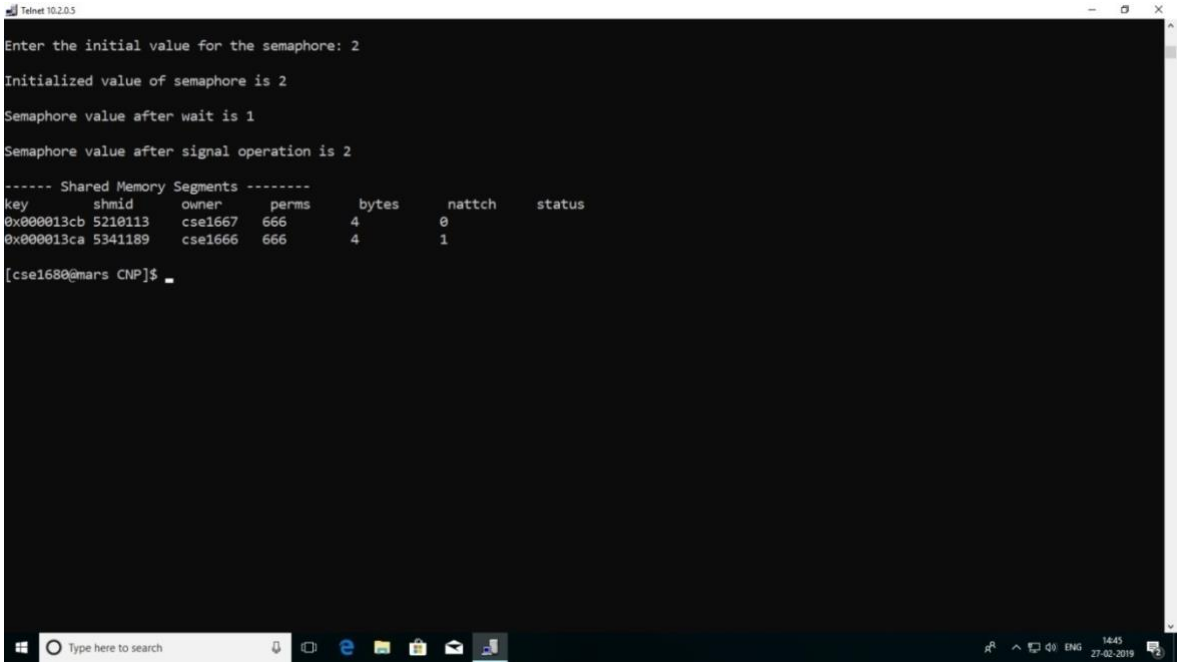
```
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
printf("\nSemaphore value after signal operation is %d\n",csval);
rval=sem_destroy(sem_phore);
if(rval==-1)
{
        perror("SEM-DESTROY-ERR:");
        shmdt(sem_phore);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
rval=shmdt(sem_phore);
if(rval==-1)
{
        perror("SHM-DETACH-ERR:");
        shmdt(sem_phore);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
rval=shmctl(shmid,IPC_RMID,0);
if(rval==-1)
{
        perror("SHM-REM-ERR:");
        shmdt(sem_phore);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
```

```
        system("ipcs -m");
}
```

OUTPUT:

compilation : gcc –lpthread operations_Sem.c

execution : ./a.out



```
Enter the initial value for the semaphore: 2

Initialized value of semaphore is 2

Semaphore value after wait is 1

Semaphore value after signal operation is 2

------ Shared Memory Segments --------
key        shmid      owner      perms      bytes      nattch     status
0x000013cb 5210113    cse1667    666        4          0
0x000013ca 5341189    cse1666    666        4          1

[cse1680@mars CNP]$
```

IMPLEMENTING IPC USING MESSAGE QUEUES AND SEMAPHORES

Program:

```
#include<stdio.h>
#include<sys/types.h>
#include<semaphore.h>
#include<unistd.h>
#include<stdlib.h>
#include<sys/shm.h>
#include<sys/ipc.h>
#include<sys/msg.h>

typedef struct msg
{
	long id;
	char txt[10];
}message;

main(int argc, char* argv[])
{
	message m1,m2;
	int label, mem_size;
	int shmid,sval,inval,rval,mqid,pid;
	int msgid; //ID for data
	sem_t *s;
	system("clear");

	if(argc<3)
	{
		printf("\nUSAGE : %s LabelForResources MemorySize(in
bytes)\n",argv[0]);
		exit(1);
	}
	label=atoi(argv[1]);
	mqid=msgget((key_t)label,IPC_CREAT|0666);
	if(mqid==-1)
```

```
{
        perror("MSG-Q-CRE-ERR:");
        exit(1);
}
system("ipcs -q");
mem_size=atoi(argv[2]); //4 bytes (sizeof(int))
//mem_size=4*atoi(argv[2])
shmid=shmget((key_t)label,mem_size,IPC_CREAT|0666);
if(shmid==-1)
{
        perror("SHM_MEM-CRE-ERR:");
        msgctl(mqid,IPC_RMID,0);
        exit(1);
}
system("ipcs -m");
s=(sem_t*)shmat(shmid,0,0);
if(s==NULL)
{
        perror("SHM-AT-ERR:");
        shmctl(shmid,IPC_RMID,0);
        shmdt(s);
        msgctl(mqid,IPC_RMID,0);
        exit(1);
}
printf("\nEnter the initialization value for the semaphore :");
scanf("%d",&inval);
rval=sem_init(s,1,inval);
if(rval==-1)
{
        perror("Unable to initialize semaphore value:");
        msgctl(mqid,IPC_RMID,0);
        sem_destroy(s);
        shmdt(s);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
rval=sem_getvalue(s,&sval);
```

```
if(rval==-1)
{
        perror("Unable to get semaphore value:");
        msgctl(mqid,IPC_RMID,0);
        sem_destroy(s);
        shmdt(s);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
printf("\nSemaphore value after initialization is %d\n",sval);
printf("\nEnter the message ID to be used between parent and child: ");
scanf("%d",&msgid);

pid=fork();
if(pid==-1)
{
        perror("FRK-ERR:");
        msgctl(mqid,IPC_RMID,0);
        sem_destroy(s);
        shmdt(s);
        shmctl(shmid,IPC_RMID,0);
        exit(1);
}
if(pid==0)
{
        printf("\nCHILD : pid = %d\n",getpid());
        rval=sem_wait(s);
        if(rval==-1)
        {
                perror("SEM-WAIT-ERR:");
                msgctl(mqid,IPC_RMID,0);
                sem_destroy(s);
                shmdt(s);
                shmctl(shmid,IPC_RMID,0);
                exit(1);
        }
        printf("\nCHILD : Enter the message to be sent to parent : ");
```

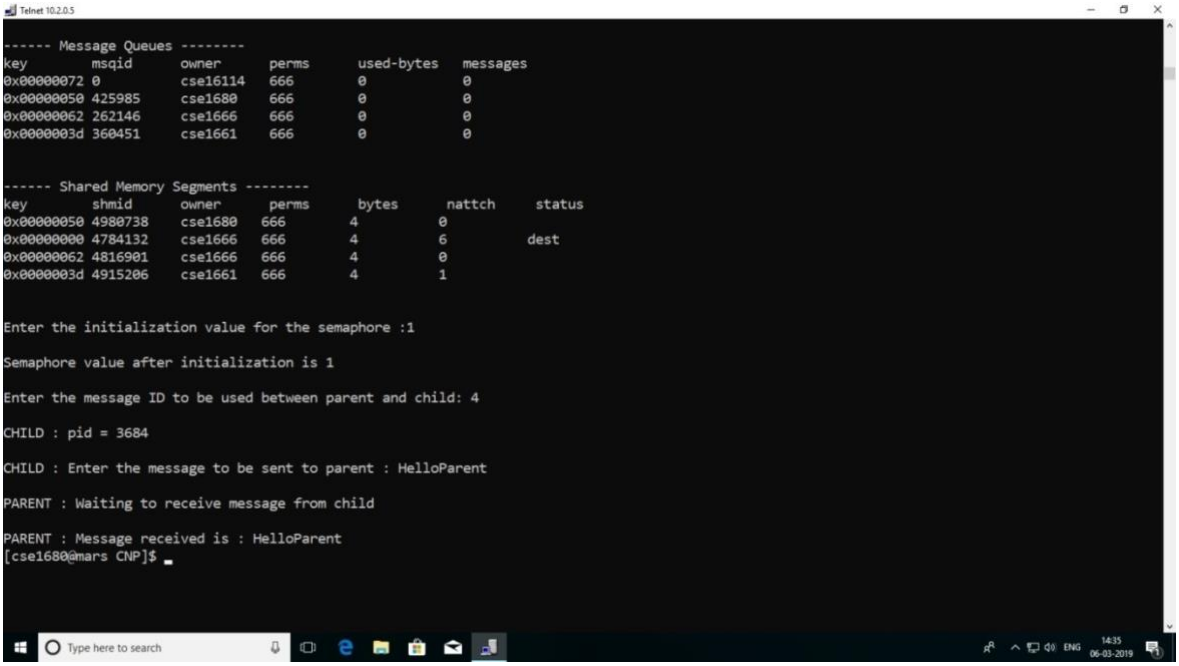
```
		scanf("%s",m1.txt);
		m1.id=msgid;
		rval=msgsnd(mqid,(message*)&m1,sizeof(m1),0);
		if(rval==-1)
		{
			perror("MSG-SND-ERR:");
			msgctl(mqid,IPC_RMID,0);
			sem_destroy(s);
			shmdt(s);
			shmctl(shmid,IPC_RMID,0);
			exit(1);
		}
		rval=sem_post(s);
		if(rval==-1)
		{
			perror("SEM-POST-ERR:");
			msgctl(mqid,IPC_RMID,0);
			sem_destroy(s);
			shmdt(s);
			shmctl(shmid,IPC_RMID,0);
			exit(1);
		}
		exit(1);
	}
	else
	{
		rval=sem_wait(s);
		if(rval==-1)
		{
			perror("SEM-WAIT-ERR:");
			msgctl(mqid,IPC_RMID,0);
			sem_destroy(s);
			shmdt(s);
			shmctl(shmid,IPC_RMID,0);
			exit(1);

		}
```

```
                printf("\nPARENT : Waiting to receive message from child\n");
                rval=msgrcv(mqid,(message*)&m2,sizeof(m2),msgid,0);
                if(rval==-1)
                {
                        perror("MSG-RCV-ERR:");
                        msgctl(mqid,IPC_RMID,0);
                        sem_destroy(s);
                        shmdt(s);
                        shmctl(shmid,IPC_RMID,0);
                        exit(1);
                }
                printf("\nPARENT : Message received is : %s\n",m2.txt);
                rval=sem_post(s);
                if(rval==-1)
                {
                        perror("SEM-POST-ERR:");
                        msgctl(mqid,IPC_RMID,0);
                        sem_destroy(s);
                        shmdt(s);
                        shmctl(shmid,IPC_RMID,0);
                        exit(1);
                }
                msgctl(mqid,IPC_RMID,0);
                sem_destroy(s);
                shmdt(s);
                shmctl(shmid,IPC_RMID,0);
        }
}
```

OUTPUT:

compilation : gcc –lpthread sem_msgQ.c

execution : ./a.out



```
------ Message Queues --------
key        msqid      owner      perms      used-bytes   messages
0x00000072 0          cse16114   666        0            0
0x00000050 425985     cse1680    666        0            0
0x00000062 262146     cse1666    666        0            0
0x0000003d 360451     cse1661    666        0            0


------ Shared Memory Segments --------
key        shmid      owner      perms      bytes      nattch     status
0x00000050 4980738    cse1680    666        4          0
0x00000000 4784132    cse1666    666        4          6          dest
0x00000062 4816901    cse1666    666        4          0
0x0000003d 4915206    cse1661    666        4          1


Enter the initialization value for the semaphore :1

Semaphore value after initialization is 1

Enter the message ID to be used between parent and child: 4

CHILD : pid = 3684

CHILD : Enter the message to be sent to parent : HelloParent

PARENT : Waiting to receive message from child

PARENT : Message received is : HelloParent
[cse1680@mars CNP]$
```

IMPLEMENTING TALKER-LISTENER

Program:

```
/*TALKER PROGRAM*/

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

main(int argc,char* argv[])
{
        int rval,sockid,itr,i;
        char msg[100];
        struct sockaddr_in lis;
        system("clear");
        if(argc<3)
        {
                printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
                exit(1);
        }
        /*DEFINITION OF SERVICE*/
        lis.sin_family=AF_INET;
        lis.sin_port=htons(atoi(argv[2]));
        lis.sin_addr.s_addr=inet_addr(argv[1]);

        sockid=socket(AF_INET,SOCK_DGRAM,0);
        if(sockid==-1)
        {
                perror("SOCK-CRE-ERR:");
                exit(1);
        }

        printf("\nEnter the number of messages to be sent: ");
        scanf("%d",&itr);
        for(i=1;i<=itr;i++)
```

```
        {
                strncpy(msg," ",100);
                printf("Enter the message %d :  ",i);
                scanf("%s",msg);
                rval=sendto(sockid,msg,sizeof(msg),0,(struct sockaddr*)&lis,sizeof(lis));
                if(rval<=0)
                {
                        perror("MSG-SND-ERR:");
                        close(sockid);
                        exit(1);
                }
                printf("\nMessage sent successfully\n");
                if(strcmp(msg,"EXIT")==0)
                {
                        close(sockid);
                        exit(1);
                }
        }
        close(sockid);
}
/*LISTENER PROGRAM*/
#include<stdio.h>
#include<stdlib.h>
#include<sys/socket.h>
#include<sys/types.h>
#include<netinet/in.h>
#include<string.h>

main(int argc,char* argv[])
{
        int sockid,rval,count=0,tlen;
        char msg[100];
        struct sockaddr_in lis,talk;
        system("clear");
        if(argc<3)
        {
```

```
		printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
		exit(1);
}
/*DEFINITION OF SERVICE*/
lis.sin_family=AF_INET;
lis.sin_port=htons(atoi(argv[2]));
lis.sin_addr.s_addr=inet_addr(argv[1]);

sockid=socket(AF_INET,SOCK_DGRAM,0);
if(sockid==-1)
{
		perror("SOCK-CRE-ERR:");
		exit(1);
}

/*BIND - SERVER IS LISTENING*/
rval=bind(sockid,(struct sockaddr*)&lis,sizeof(lis));
if(rval==-1)
{
		perror("BIND-ERR:");
		close(sockid);
		exit(1);
}
printf("\nThe Listener is ready to accept messages\n");
tlen=sizeof(talk);
while(1)
{
		strncpy(msg," ",100);
		rval=recvfrom(sockid,msg,sizeof(msg),0,(struct sockaddr*)&talk,&tlen);
		if(rval==-1)
		{
			perror("MSG-RCV-ERR:");
			close(sockid);
			exit(1);
		}
		printf("\nMessage %d read is %s\n",++count,msg);
		if(!strcmp(msg,"EXIT"))
```

```
                                break;
            }
            close(sockid);
}
```

OUTPUT:

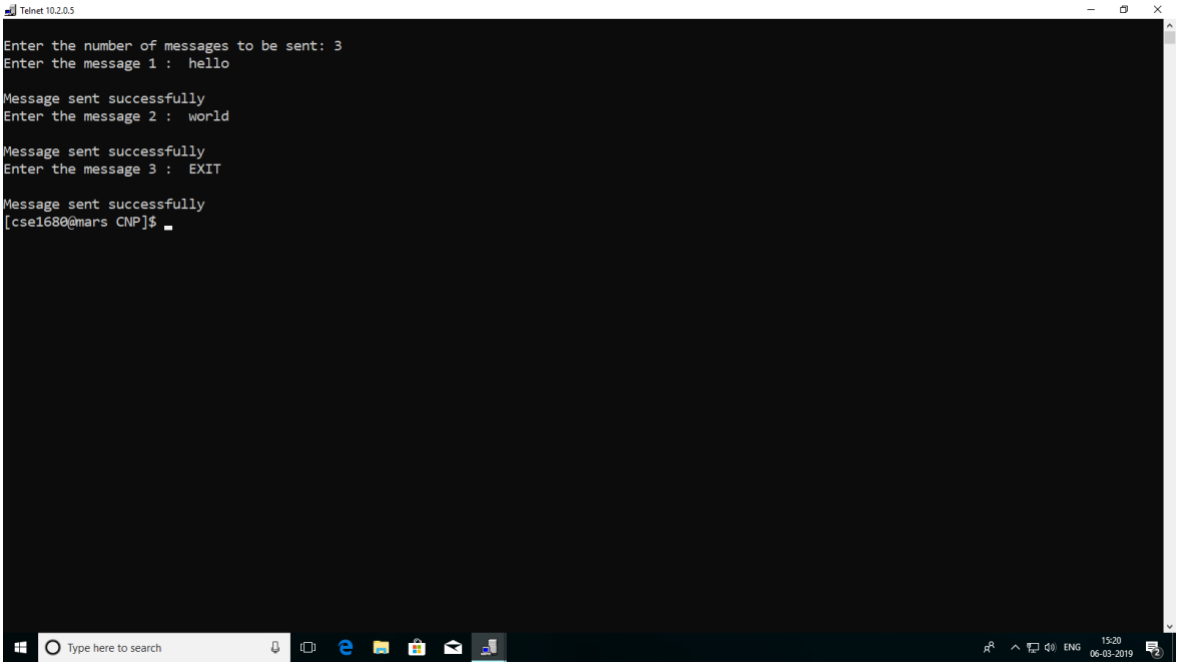
compilation : *gcc –o t udpTalker1.c*

gcc –o l udpListener.c

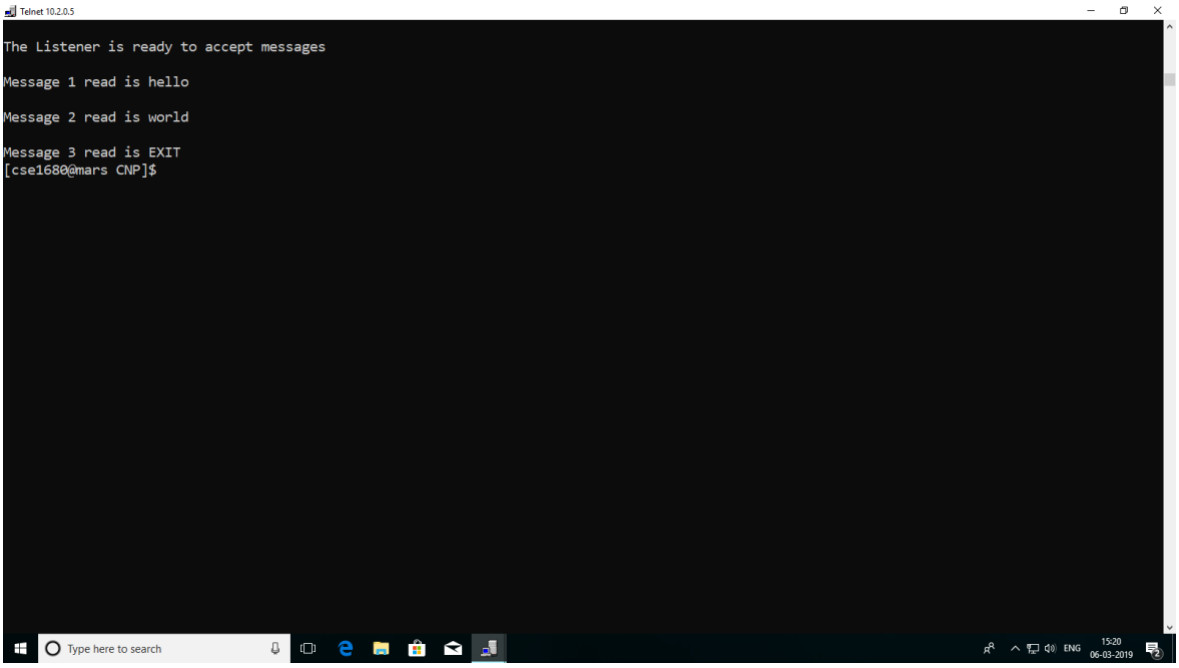
execution : *./l 10.2.0.5 5080 (Execute first and in terminal 1)*

./t 10.2.0.5 5080 (Execute second and in terminal 2)

TALKER



LISTENER



IMPLEMENT MINI DNS

Program:

```
/*CREATING DNSfile.txt*/

lab7 10.2.0.7

lab9 10.2.0.9

lab6 10.2.0.6

/*DNS CLIENT PROGRAM*/

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

main(int argc,char* argv[])
{
        struct sockaddr_in dnss;
        int sockid,rval;
        char sym[20],IP[20];
        int slen;
        system("clear");
        if(argc<3)
        {
                printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
                exit(1);
        }
        sockid=socket(AF_INET,SOCK_DGRAM,0);
        if(sockid==-1)
        {
                perror("SOCK-CRE-ERR:");
                exit(1);
        }
        dnss.sin_family=AF_INET;
        dnss.sin_port=htons(atoi(argv[2]));
```

```
        dnss.sin_addr.s_addr=inet_addr(argv[1]);

        printf("\nEnter the symbolic name of resource : ");
        scanf("%s",sym);

        rval=sendto(sockid,sym,sizeof(sym),0,(struct sockaddr*)&dnss,sizeof(dnss));
        if(rval==-1)
        {
                perror("MSG-SND-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nWaiting to receive from DNS Server\n");
        slen=sizeof(dnss);
        strncpy(IP," ",20);
        rval=recvfrom(sockid,IP,sizeof(IP),0,(struct sockaddr*)&dnss,&slen);
        if(rval==-1)
        {
                perror("MSG-RCV-ERR:");
                close(sockid);
                exit(1);
        }
        printf("\nEquivalent IP adrress of %s is %s\n",sym,IP);
        close(sockid);
}
/*DNS SERVER PROGRAM*/

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

main(int argc,char* argv[])
{
        struct sockaddr_in dnss,dnsc;
```

```
int rval,sockid,flag=0,clen;
char sym[20],IP[20],dnsFile[20],dnsName[20];
FILE *fptr;
system("clear");
if(argc<3)
{
        printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
        exit(1);
}
dnss.sin_family=AF_INET;
dnss.sin_port=htons(atoi(argv[2]));
dnss.sin_addr.s_addr=inet_addr(argv[1]);

sockid=socket(AF_INET,SOCK_DGRAM,0);
if(sockid==-1)
{
        perror("SOCK-CRE-ERR:");
        exit(1);
}

rval=bind(sockid,(struct sockaddr*)&dnss,sizeof(dnss));
if(rval==-1)
{
        perror("BIND-ERR:");
        close(sockid);
        exit(1);
}

printf("\nDNS Server waiting for request\n");
printf("\nEnter the DNS file name : ");
scanf("%s",dnsFile);
/*OPEN THE FILE*/
fptr=fopen(dnsFile,"r");
if(fptr==NULL)
{
        perror("FILE-OPEN-ERR:");
        close(sockid);
```

```
		exit(1);
	}
	clen=sizeof(dnsc);
	rval=recvfrom(sockid,sym,sizeof(sym),0,(struct sockaddr*)&dnsc,&clen);
	if(rval==-1)
	{
		perror("MSG-RCV-ERR:");
		close(sockid);
		fclose(fptr);
		exit(1);
	}
	printf("\nIP requested for %s\n",sym);
	while((fscanf(fptr,"%s%s",dnsName,IP) != EOF) )
	{
		if(strcmp(dnsName,sym)==0)
		{
			rval=sendto(sockid,IP,sizeof(IP),0,(struct
sockaddr*)&dnsc,clen);
			if(rval==-1)
			{
				perror("MSG-SND-ERR:");
				fclose(fptr);
				close(sockid);
				exit(1);
			}
			flag=1;
		}
		printf("\n flag value in loop is %d\n",flag);
		if(flag==1) //INDICATES THAT MATCH IS FOUND
			break;
	}
	if(flag==0)
	{
		printf("\n invalid domain name case\n");
		rval=sendto(sockid,"NOT FOUND",sizeof("NOT FOUND"),0,(struct
sockaddr*)&dnsc,clen);
		if(rval==-1)
```

```
                {
                        perror("MSG-SND-ERR:");
                        fclose(fptr);
                        close(sockid);
                        exit(1);
                }
        }
        fclose(fptr);
        close(sockid);
}
```

OUTPUT:

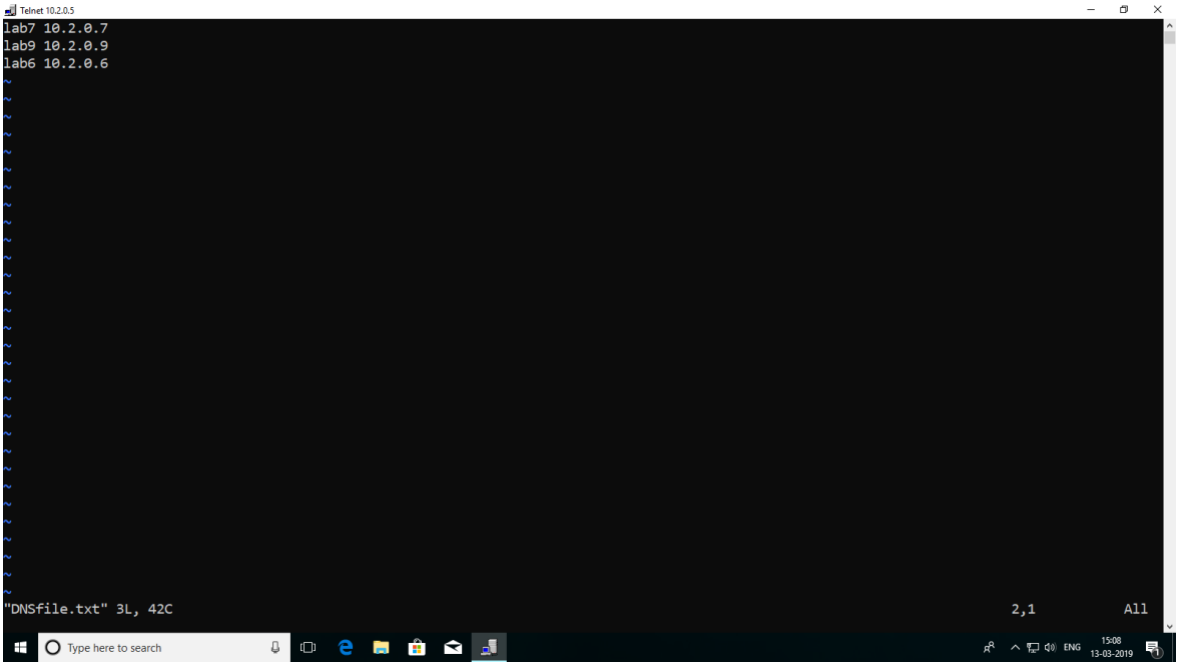
compilation : *gcc –o cout dnsClient.c*

gcc –o sout dnsServer.c

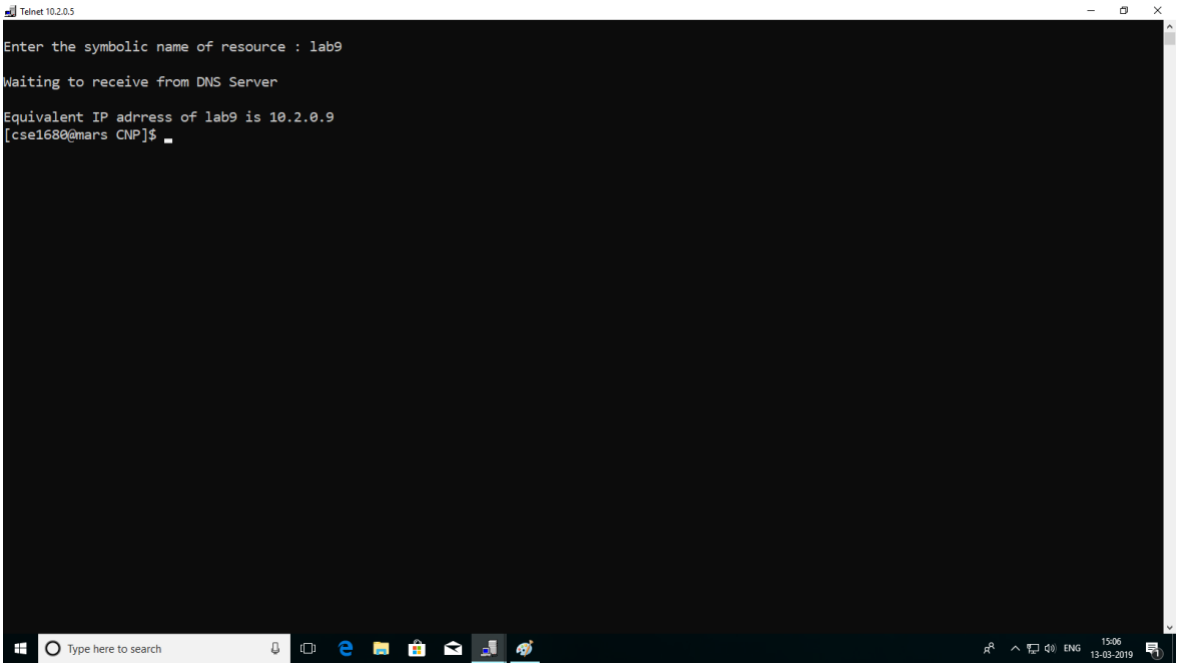
execution : *./sout 10.2.0.5 5080 (Execute server first and in terminal 1)*

./cout 10.2.0.5 5080 (Execute client second and in terminal 2)

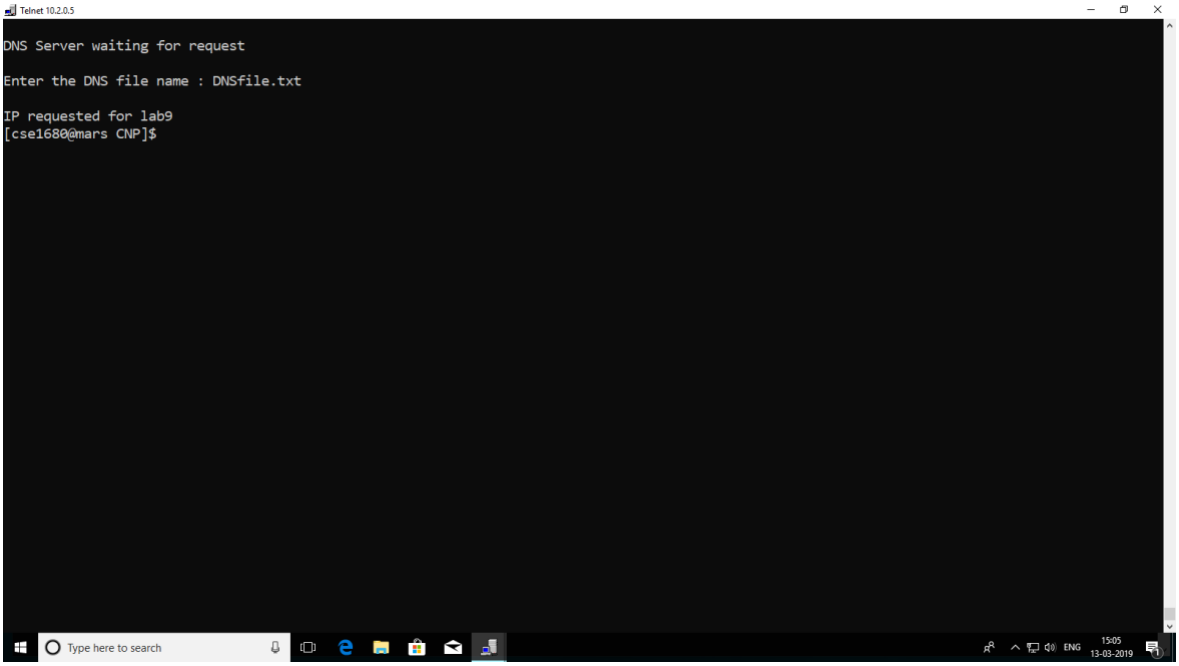
DNSfile.txt



DNS CLIENT



DNS SERVER


Telnet 10.2.0.5
DNS Server waiting for request
Enter the DNS file name : DNSfile.txt
IP requested for lab9
[cse1680@mars CNP]$
Type here to search
ENG
15:05
13-03-2019

DEMONSTRATE NON-BLOCKING I/O USING select SYSTEM CALL

Program:

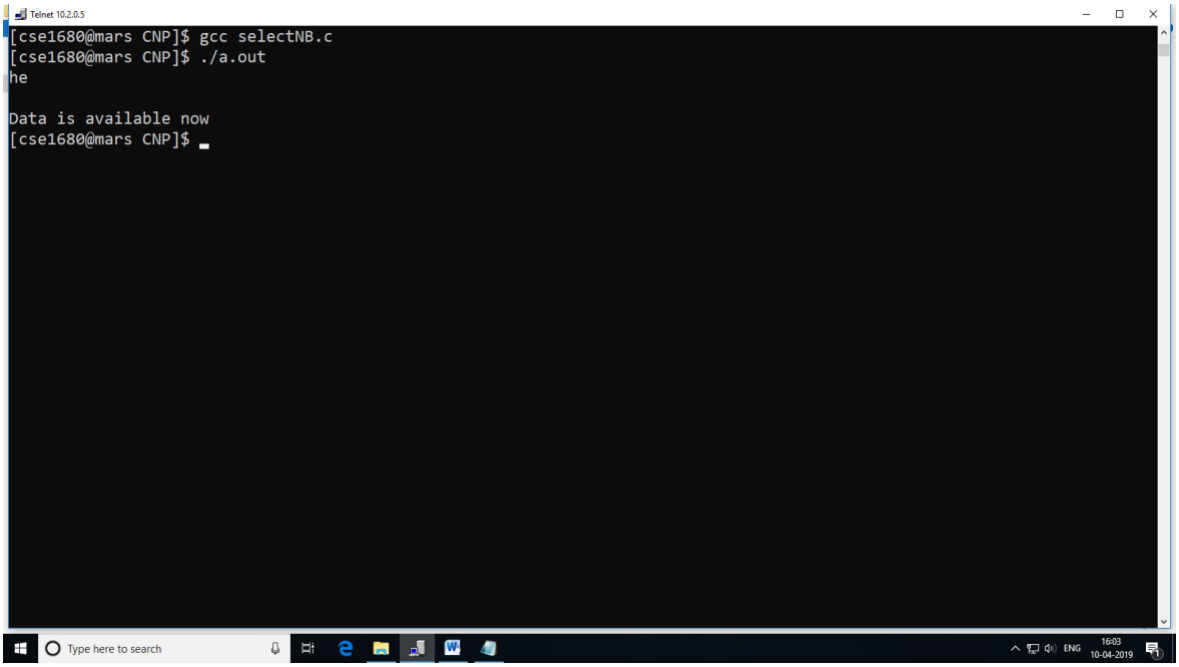
```
/*selectNB.c*/

#include<stdio.h>
#include<stdlib.h>
#include<sys/time.h>
#include<sys/types.h>
#include<unistd.h>

int main(void)
{
	fd_set rfds;
	struct timeval tv;
	int retval;
		char a[100];
	FD_ZERO(&rfds);
	FD_SET(0,&rfds);

	tv.tv_sec=5;
	tv.tv_usec=0;

	retval=select(1,&rfds,NULL,NULL,&tv);

	if(retval==-1)
		perror("select()");
	else if(retval)
		{
		printf("\nData is available now\n");
				scanf("%s",&a);
		}
	else
		printf("No data within five Seconds.\n");
	exit(EXIT_SUCCESS);
}
```

OUTPUT:

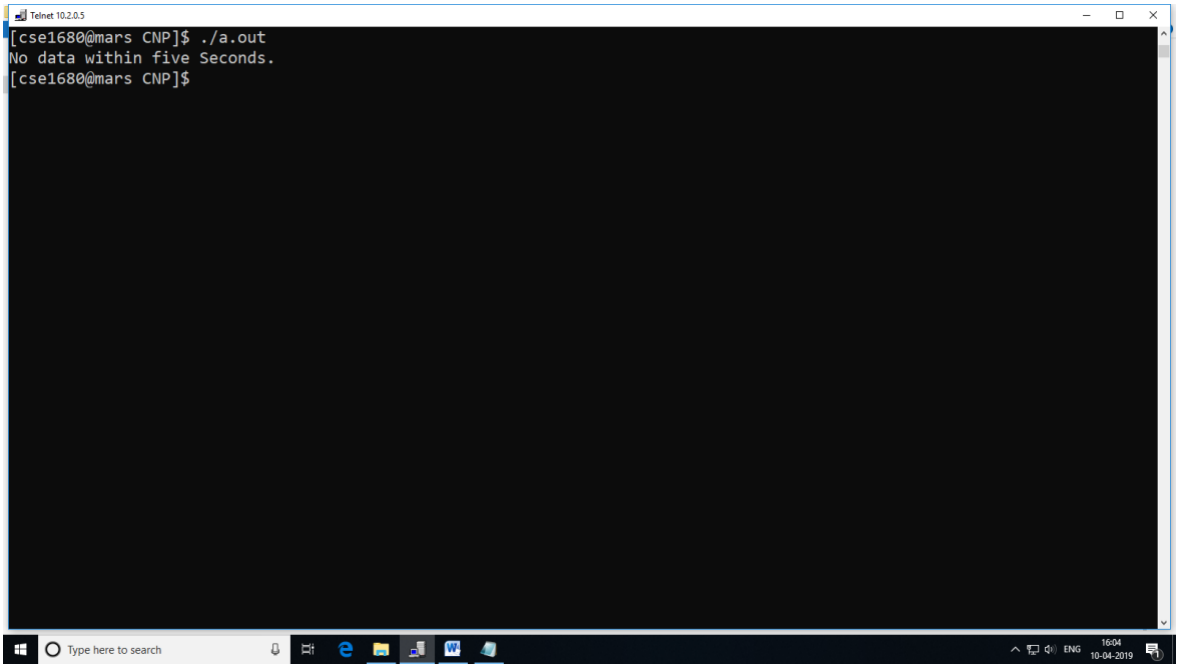
Compilation : gcc selectNB.c

Execution : ./a.out

WHEN DATA IS AVAILABLE



WHEN NO DATA IS AVAILABLE



DEMONSTRATE SCATTER AND GATHER I/O USING readv() AND writev()

Program:

/*readFrom.txt*/

HelloWorld

/*writeTo.txt*/

GoodAfternoon
à„ P ˆuä ðuä¿p– å, .N= t

/*readWrite.c*/

```
#include<stdio.h>
#include<stdlib.h>
#include<sys/uio.h>
#include<string.h>
#include<sys/types.h>
#include<fcntl.h>
#include<sys/stat.h>

main()
{
        struct iovec iov[3];
        char s[40],s1[30],s2[25],fname[10],cmdstr[40];
        int i,rval,fd,choice;

        system("clear");

        iov[0].iov_base=s;
        iov[0].iov_len=sizeof(s);

        iov[1].iov_base=s1;
        iov[1].iov_len=sizeof(s1);

        iov[2].iov_base=s2;
        iov[2].iov_len=sizeof(s2);
```

```
	printf("\nEnter your choice to read data from standard input or file:\n\t1.Standard
Input\n\t2.File\n");
	scanf("%d",&choice);
	printf("\nChoice : %d\n",choice);
	if(choice==1)
	{
		fd=0;
		printf("\nReading from keyboard and writing to multiple buffers\n");
	}
	else
	{
		if(choice==2)
		{
			printf("\nEnter the filename: ");
			scanf("%s",fname);

			fd=open(fname,O_RDONLY);
			if(fd==-1)
			{
				perror("FILE-OPEN-ERR:");
				exit(1);
			}
		}
		else
		{
			printf("\nInvalid Choice\n");
			exit(1);
		}
	}
	rval=readv(fd,(struct iovec*)iov,3);
	printf("\nAfter readv\n");
	s[39]='\0';
	s1[29]='\0';
	s2[24]='\0';

	printf("\nrval = %d\n",rval);
```

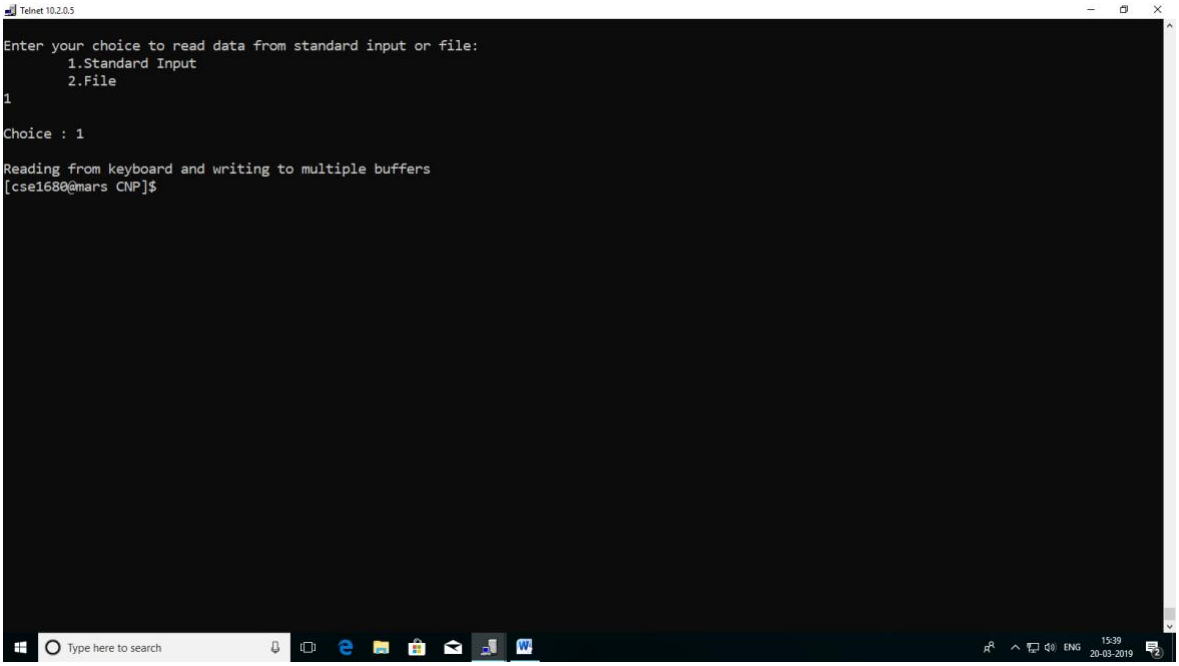
```
        if(rval!=-1)
        {
                printf("\nContents of the three buffers are:\n");
                printf("Data in s is %s\t%d\n",s,strlen(s));
                printf("Data in s1 is %s\t%d\n",s1,strlen(s1));
                printf("Data in s2 is %s\t%d\n",s2,strlen(s2));
        }
        else
        {
                perror("RDV-ERR:");
        }
        if(choice==2)
                close(fd);
        printf("\nEnter the filename to write to: ");
        scanf("%s",fname);
        fd=open(fname,O_RDWR|O_CREAT|O_TRUNC,S_IRWXU);
        if(fd!=-1)
                rval=writev(fd,(struct iovec*)iov,3);
        if(rval!=-1)
                printf("\n%d Bytes written to %s file\n",rval,fname);
        close(fd);
        strncpy(cmdstr," ",40);
        strcpy(cmdstr,"chmod 700 ");
        strcat(cmdstr,fname);
        strcat(cmdstr,"; ");
        strcat(cmdstr,"cat ");
        strcat(cmdstr,fname);
        printf("\ncmdstr = %s\n",cmdstr);
        system(cmdstr);
}
```

OUTPUT:

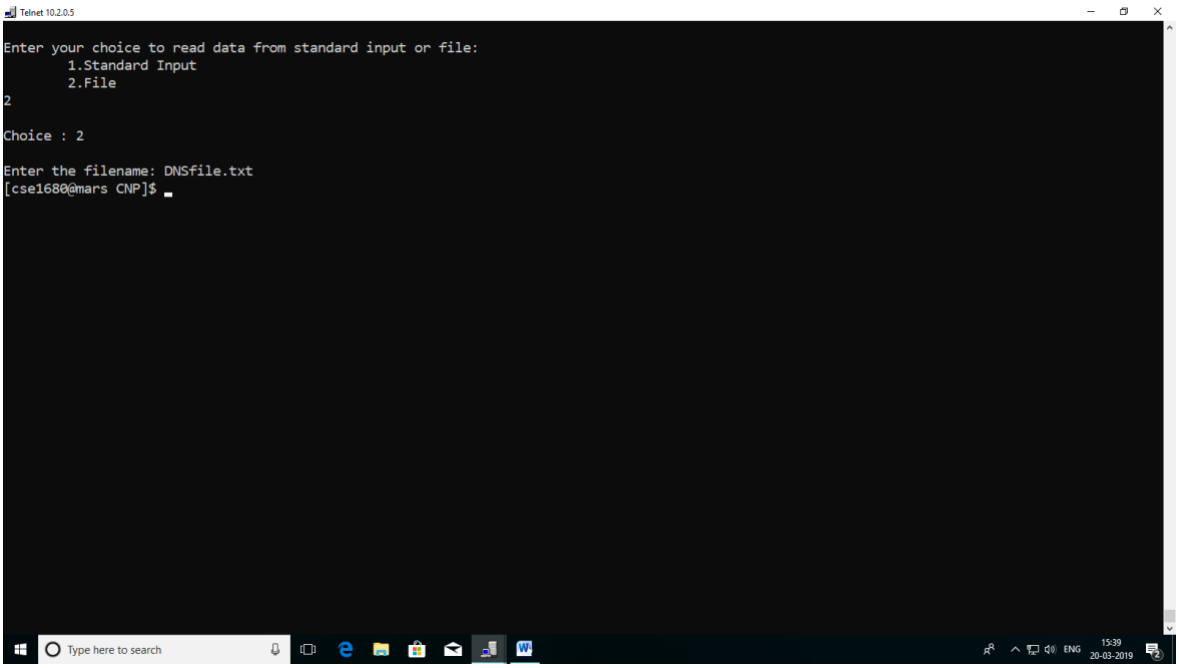
Compilation : gcc readWrite.c

Execution : ./a.out

STANDARD INPUT



FILE



DEMONSTRATE SOCKET OPTIONS

Program:

```
#include<stdio.h>
#include<stdlib.h>
#include<netinet/in.h>
#include<string.h>
#include<sys/types.h>
#include<sys/socket.h>
#include<netinet/tcp.h>
main()
{
        int optlen,gs,sockopt,sockid;
        sockid=socket(AF_INET,SOCK_STREAM,0);
        if(sockid==-1)
        {
                perror("SOCK-CRE-ERR:");
                exit(1);
        }
        /*LEVEL-SOCKET OPTION-SOCKET TYPE*/
        optlen=sizeof(sockopt);
        gs=getsockopt(sockid,SOL_SOCKET,SO_TYPE,&sockopt,&optlen);
        if(gs==-1)
        {
                perror("GETSOCK-ERR:");
                close(sockid);
                exit(1);
        }
        switch(sockopt)
        {
                case SOCK_DGRAM         :       printf("\nDatagram
Socket\n");
                                                break;
                case SOCK_STREAM        :       printf("\nStream Socket\n");
                                                break;
                case SOCK_RAW           :       printf("\nRaw Socket\n");
                                                break;
```

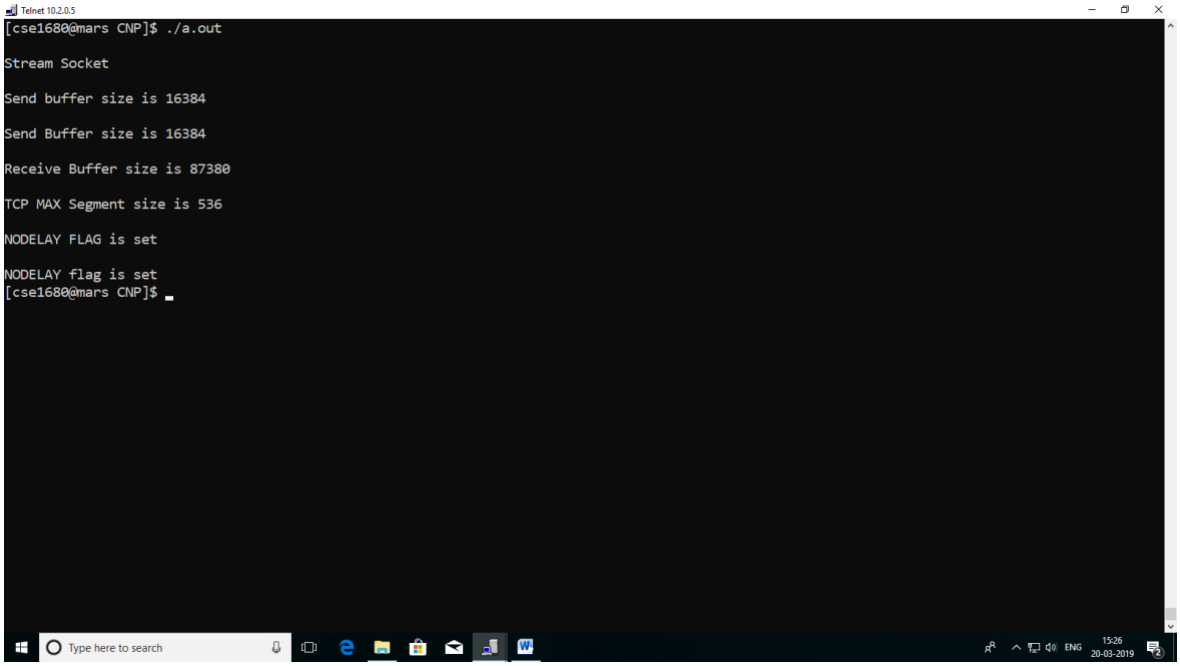
```
                default                 :       printf("\nUnknown Socket
type\n");
        }
        /*LEVEL-SOCKET OPTION-SEND QUEUE BUFFER SIZE*/
        optlen=sizeof(sockopt);
        gs=getsockopt(sockid,SOL_SOCKET,SO_SNDBUF,&sockopt,&optlen);
        if(gs!=-1)
                printf("\nSend buffer size is %d\n",sockopt);
        else
                perror("SND-BUF-ERR:");
        //Usage of setsockopt function
        /*LEVEL-SOCKET OPTION-SEND QUEUE BUFFER SIZE setting size of 2048
Note Default size is 4096*/
        sockopt=2048;
        optlen=sizeof(sockopt);
        gs=getsockopt(sockid,SOL_SOCKET,SO_SNDBUF,&sockopt,&optlen);
        if(gs!=-1)
                printf("\nSend Buffer size is %d\n",sockopt);
        else
                perror("SND-BUF-ERR:");

        /*LEVEL-SOCKET OPTION-RECEIVE QUEUE BUFFER SIZE*/
        optlen=sizeof(sockopt);
        gs=getsockopt(sockid,SOL_SOCKET,SO_RCVBUF,&sockopt,&optlen);
        if(gs!=-1)
                printf("\nReceive Buffer size is %d\n",sockopt);
        else
                perror("RCV-BUF-ERR:");

        /*LEVEL-TCP OPTION-TCP MAX SEGMENT SIZE*/
        optlen=sizeof(sockopt);
        gs=getsockopt(sockid,IPPROTO_TCP,TCP_MAXSEG,&sockopt,&optlen);
        if(gs!=-1)
                printf("\nTCP MAX Segment size is %d\n",sockopt);
        else
                perror("TCP-SEG-ERR:");
```

```
	/*LEVEL-TCP OPTION-TCP NO-DELAY*/
	optlen=sizeof(sockopt);
	sockopt=1;
	gs=setsockopt(sockid,IPPROTO_TCP,TCP_NODELAY,&sockopt,optlen);
	if(gs!=-1)
		printf("\nNODELAY FLAG is set\n");
	else
		perror("TCP-NODELAY-ERR:");

	//Usage of setsockopt function
	/*LEVEL-TCP OPTION-TCP NODELAY*/
	optlen=sizeof(sockopt);
	gs=getsockopt(sockid,IPPROTO_TCP,TCP_NODELAY,&sockopt,&optlen);
	if(gs!=-1)
		if(sockopt==1)
			printf("\nNODELAY flag is set\n");
		else
			printf("\nNODELAY flag not set\n");
	else
		perror("TCP-NODELAY-ERR:");

	close(sockid);
}
```

OUTPUT:

Compilation : gcc sockOpt.c

Execution : ./a.out



DEMONSTRATE USAGE OF select() SYSTEM CALL WITH SOCKET DESCRIPTOR

Program:

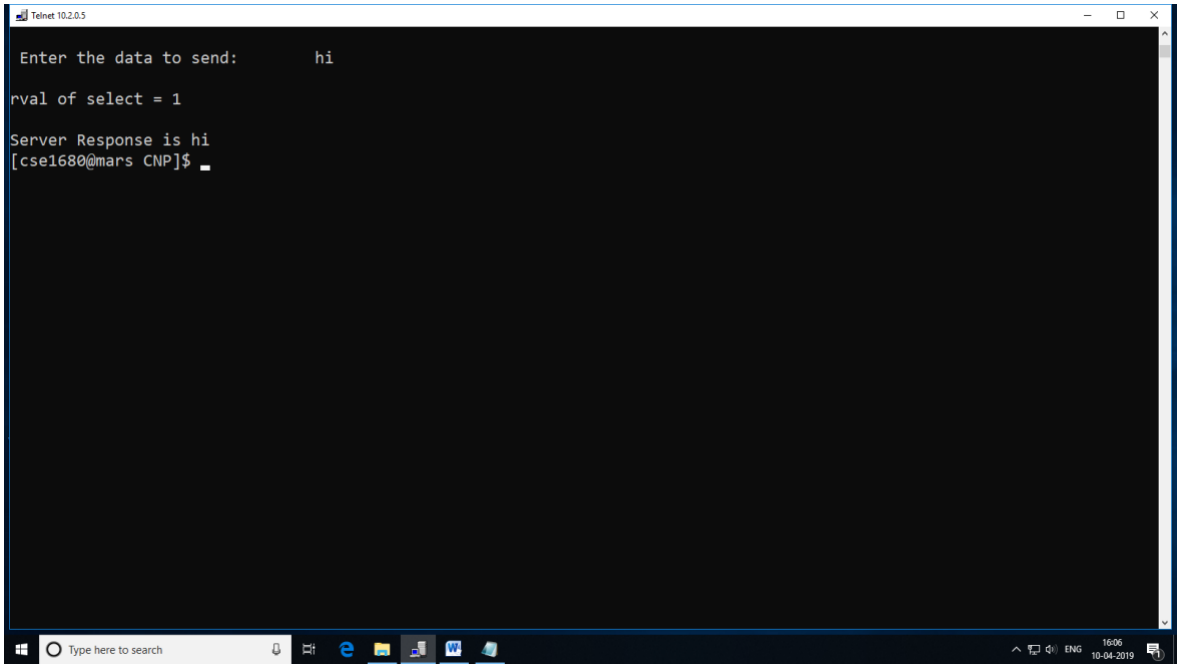
```
#include<unistd.h>
#include<stdio.h>
#include<stdlib.h>
#include<sys/types.h>
#include<sys/socket.h>
#include<netinet/in.h>
#include<string.h>

main(int argc,char* argv[])
{
        fd_set rdfs;
        int rval,sockfd;
        char buf1[3],buf2[30];
        struct sockaddr_in s;
        struct timeval tv;

        system("clear");
        if(argc<2)
        {
                printf("\nUSAGE : %s IP_ADDR PORT#\n",argv[0]);
                exit(1);
        }

        s.sin_family=AF_INET;
        s.sin_port=htons(atoi(argv[2]));
        s.sin_addr.s_addr=inet_addr(argv[1]);

        sockfd=socket(AF_INET,SOCK_STREAM,6);
        if(sockfd==-1)
        {
                perror("SOCK-CRE-ERR:");
                exit(1);
        }
```

```
        rval=connect(sockfd,(struct sockaddr *)&s,sizeof(s));
        if(rval==-1)
        {
                perror("CONNECT_ERR");
                close(sockfd);
                exit(1);
        }

        printf("\n Enter the data to send:\t");
        scanf("%s",buf1);

        send(sockfd,(char *) buf1,sizeof(buf1),0);
        do
        {
                FD_ZERO(&rdfs);
                FD_SET(sockfd,&rdfs);
                rval=select(sockfd+1,&rdfs,NULL,NULL,NULL);
                printf("\nrval of select = %d\n",rval);
        }while(rval==-1);

        if(rval>0)
        {
                if(FD_ISSET(sockfd,&rdfs))
                {
                        rval=recv(sockfd,(char *)buf2,sizeof(buf2),0);
                        if(rval==0)
                                printf("\nNo response from server\n");
                        else
                                printf("\nServer Response is %s\n",buf2);
                }
        }
        else
                perror("SELECT_ERR");
        close(sockfd);
}
```

OUTPUT:

Compilation : gcc sockdtr.c

Execution : ./a.out 10.2.0.5 7 (7 is the port for Standard Echo Service)



UTILITIES : ARP (ADDRESS RESOLUTION PROTOCOL)

Description:

ARP manipulates or displays the kernel's IPv4 network neighbor cache. It can add entries to the table, delete one or display the current content.

ARP stands for ***A**ddress **R**esolution **P**rotocol*, which is used to find the media access control address of a network neighbor for a given IPv4 Address.

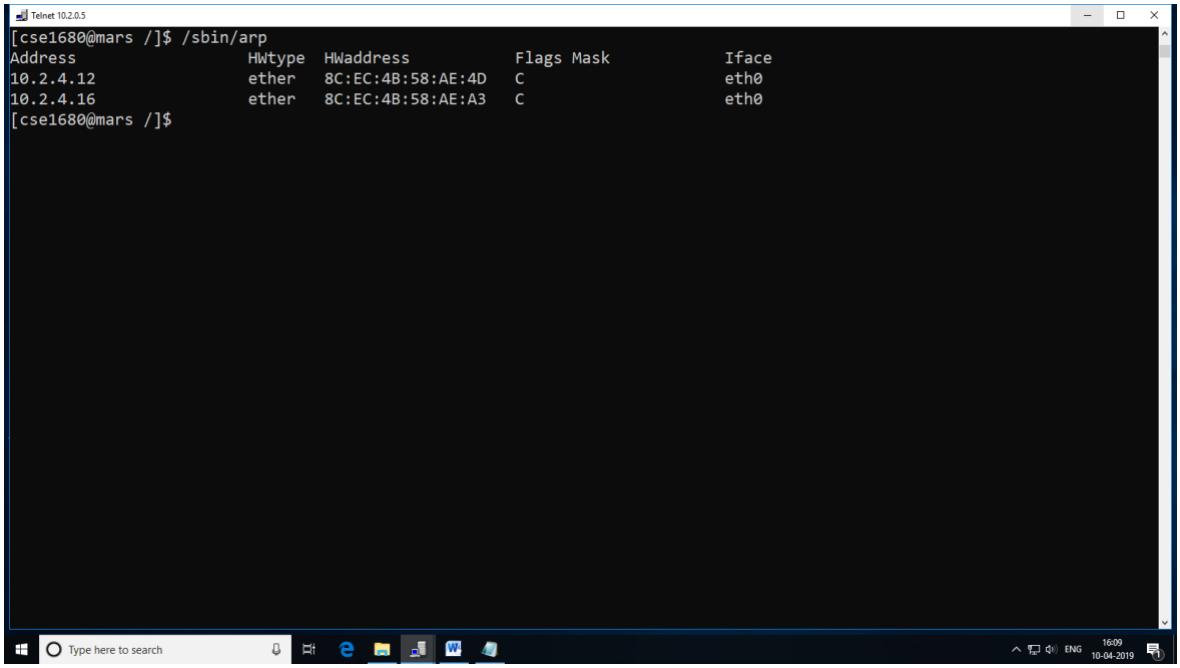
Although every machine on the Internet has one or more IP addresses, these are not sufficient for sending packets. Data Link Layer NICs (**N**etwork **I**nterface **C**ards), such as Ethernet cards, do not understand the Internet addresses. Thus, there is a need to map the logical (IP) addresses to the hardware (MAC) addresses.

The solution is to let the host, that wishes to communicate with the other hosts, output a broadcast packet on to the Ethernet (or the network) asking who owns the IP address. The host whose IP address matches will respond with its MAC address. Now both logical and hardware addresses are known, so the routing can be done uninterruptedly.

OUTPUT:

Execution : cd / (exit all directories and come to the login)

/sbin/arp



UTILITIES : IFCONFIG

Description:

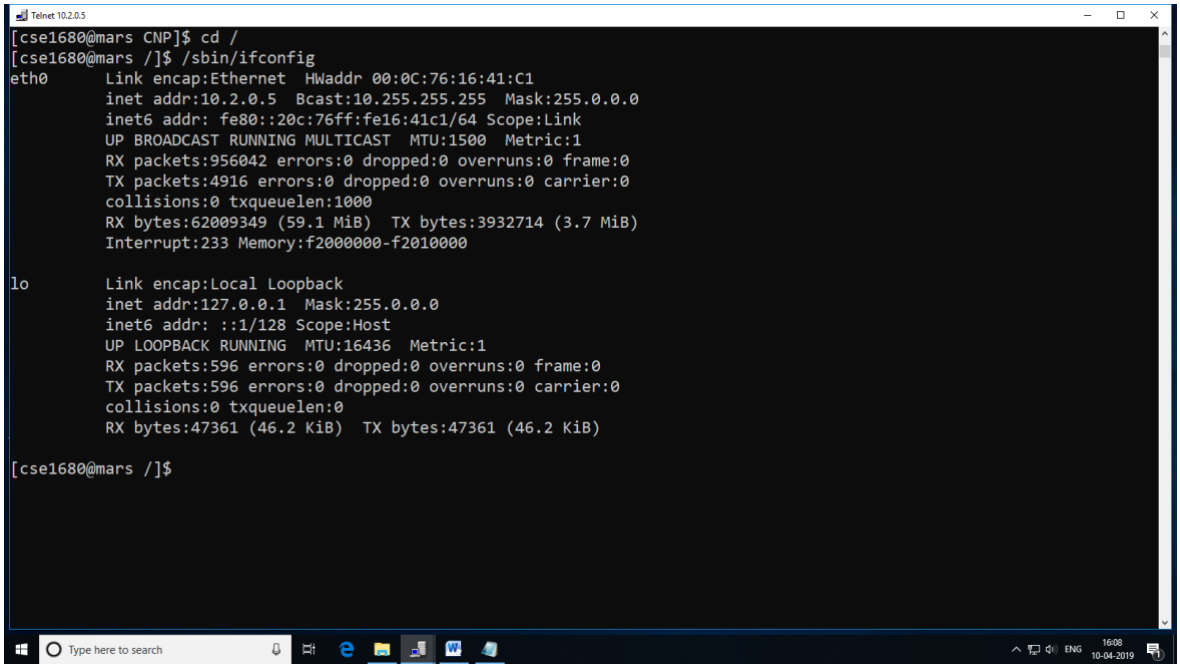
Ifconfig is used to configure the kernel-resident network interfaces. It is used at boot time to set up interfaces as necessary. After that, it is usually only needed when debugging or when system tuning is needed.

If no arguments are given, ifconfig displays the status of the currently active interfaces. If a single interface argument is given, it displays the status of the given interface only; if a single –*a* argument is given, it displays the status of all interfaces, even those that are down. Otherwise, it configures an interface.

OUTPUT:

Execution : cd / (exit all directories and come to the login)

/sbin/ifconfig



```
[cse1680@mars CNP]$ cd /
[cse1680@mars /]$ /sbin/ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0C:76:16:41:C1
          inet addr:10.2.0.5  Bcast:10.255.255.255  Mask:255.0.0.0
          inet6 addr: fe80::20c:76ff:fe16:41c1/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:956042 errors:0 dropped:0 overruns:0 frame:0
          TX packets:4916 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:62009349 (59.1 MiB)  TX bytes:3932714 (3.7 MiB)
          Interrupt:233 Memory:f2000000-f2010000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:596 errors:0 dropped:0 overruns:0 frame:0
          TX packets:596 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:47361 (46.2 KiB)  TX bytes:47361 (46.2 KiB)

[cse1680@mars /]$
```

UTILITIES : PING

Description:

ping uses the ICMP (**I**nternet **C**ontrol **M**essage **P**rotocol) protocol's mandatory *ECHO_REQUEST* datagram to elicit an ICMP *ECHO_RESPONSE* from a host or gateway. *ECHO_REQUEST* datagrams (``pings'') have an IP and ICMP header, followed by a *struct timeval* and then an arbitrary number of ``pad'' bytes used to fill out the packet.

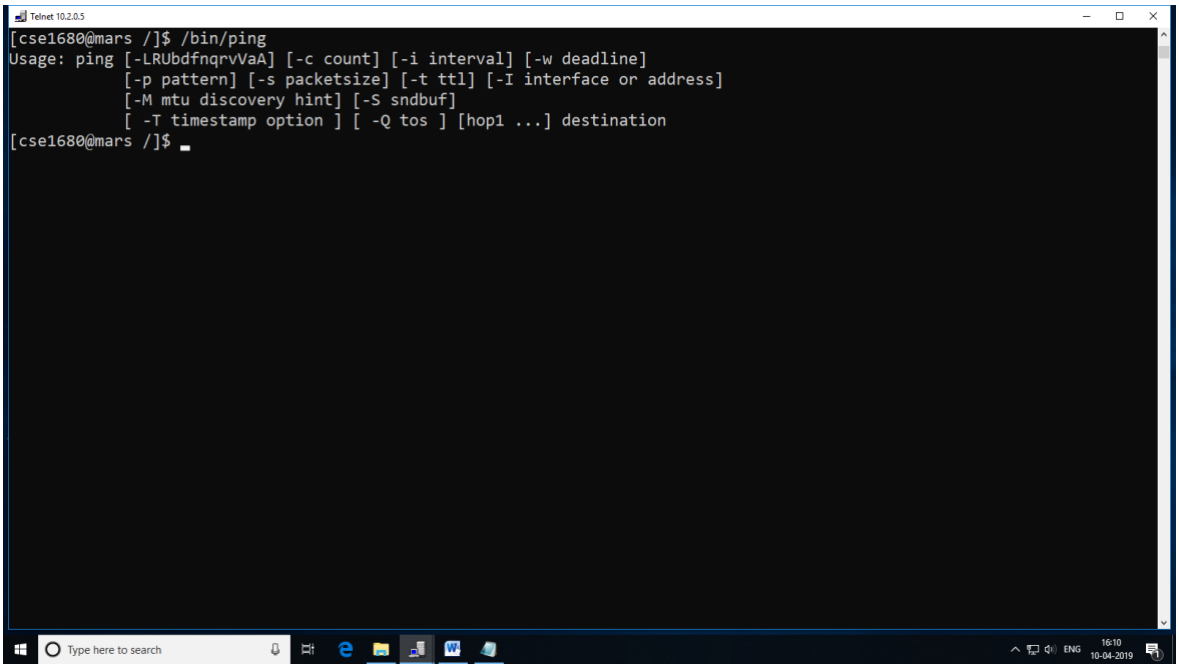
ping is used to test and check if the network/transmission line/ the service is working fine or not. When the message is sent from the host it must be echoed by the peer entity. If the response message is the exact same as the request message the service is up and on the Internet. Otherwise, some problem lies in the service or transmission. It is thus used for verifying if the service is alive and working fine.

ping6 is IPv6 version of ping, and can also send Node Information Queries (RFC4620). Intermediate hops may not be allowed, because IPv6 source routing was deprecated (RFC5095).

OUTPUT:

Execution : cd / (exit all directories and come to the login)

/bin/ping



UTILITIES : TRACEROUTE

Description:

Traceroute attempts to trace the route an IP packet follows to some internet host. It finds out intermediate hops by launching probe packets with a small **T**ime-**t**o-**L**ive (*TtL*) value, and then listens for an ICMP reply of *TIME EXCEEDED* from an intermediate router. Traceroute starts probing with a *TtL* of one, and increments by one until an ICMP port unreachable reply is received. This means the probe either got through to host, or hit the maximum *TtL*.

The host explicitly sets Time to Live field value of the IP packet in incrementally small values making sure that the packet's *TtL* exhausts at each router on the route from the host to the destination. When the *TtL* field of the IP packet hits 0 (zero) at any intermediate router then the router dispatches a *TIME EXCEEDED* ICMP message encapsulated in an IP packet. The host, from this diagnostic message, extracts the IP address of the router and thus, comes to know of its existence in the path at the *'hop count'* distance that it had set in the *TtL* field of the original packet. This way, ICMP can be smartly used to trace the routers between the sender host and the destination host.

host is the only mandatory argument, and specifies the target system, either as an IP address, or as a host name. Parameter size determines the size of the probe packets in bytes.

OUTPUT:

Execution : cd / (exit all directories and come to the login)

/bin/traceroute

```
Telnet 10.2.0.5
cse1674             *pts/1          Apr 10 16:54                        (10.2.4.16)
cse1680             *pts/2          Apr 10 16:33                        (10.2.4.16)
[cse1680@mars /]$ /bin/traceroute
Usage:
  /bin/traceroute [ -46dFITUnrAV ] [ -f first_ttl ] [ -g gate,... ] [ -i device ] [ -m max_ttl ] [ -N squeries ] [ -p po
rt ] [ -t tos ] [ -l flow_label ] [ -w waittime ] [ -q nqueries ] [ -s src_addr ] [ -z sendwait ] host [ packetlen ]
Options:
  -4                          Use IPv4
  -6                          Use IPv6
  -d  --debug                 Enable socket level debugging
  -F  --dont-fragment         Set DF (don't fragment bit) on
  -f first_ttl  --first=first_ttl
                              Start from the first_ttl hop (instead from 1)
  -g gate,...  --gateway=gate,...
                              Route packets throw the specified gateway
                              (maximum 8 for IPv4 and 127 for IPv6)
  -I  --icmp                  Use ICMP ECHO for tracerouting
  -T  --tcp                   Use TCP SYN for tracerouting
  -U  --udp                   Use UDP datagram (default) for tracerouting
  -i device  --interface=device
                              Specify a network interface to operate with
  -m max_ttl  --max-hops=max_ttl
                              Set the max number of hops (max TTL to be
                              reached). Default is 30
  -N squeries  --sim-queries=squeries
                              Set the number of probes to be tried
                              simultaneously (default is 16)
  -n                          Do not resolve IP addresses to their domain names
  -p port  --port=port        Use destination port port. It is an initial value
```

UTILITIES : FINGER

Description:

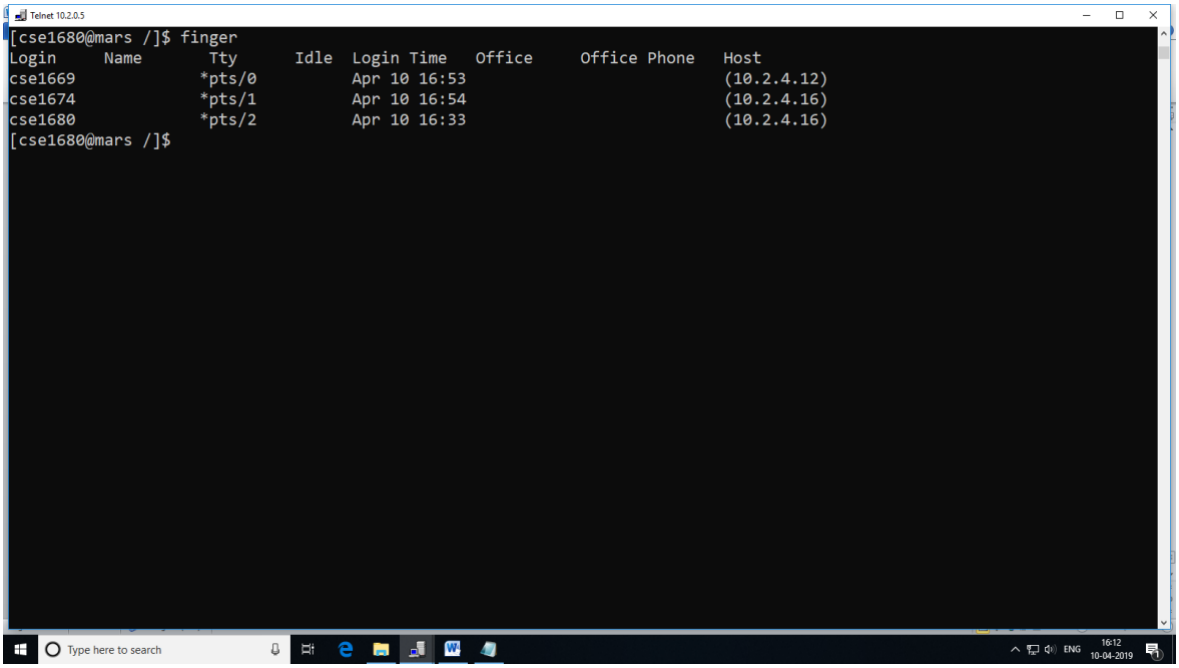
Finger may be used to look up users on a remote machine. *finger* is a program you can use to find information about computer users. It usually lists the login name, the full name, and possibly other details about the user you are fingering. These details may include the office location and phone number (if known), login time, idle time, time mail was last read, and the user's plan and project files. The information listed varies, and you may not be able to get any information from some sites.

In some cases, you may be able to use the *finger* command to verify an address or find more information for someone at another institution about whom you already have some information. The *finger* command is available on most Unix systems. It differs from the '*who is*' command, which you can use simply to find the email address of someone at another institution.

OUTPUT:

Execution : cd / (exit all directories and come to the login)

finger



RPC (REMOTE PROCEDURE CALL) : ADDITION OF TWO NUMBERS

Program:

```
/*addition.x*/

struct nums

{

        int a;

        int b;

};

program sum_prog{

version sum_ver{

        int add(nums)=1;

        }=1;

        }=0x20001080;

/*addition_client.c*/

/*
 * This is sample code generated by rpcgen.
 * These are only templates and you can use them
 * as a guideline for developing your own functions.
 */

#include "addition.h"



void
sum_prog_1(char *host)
{
            CLIENT *clnt;
            int  *result_1;
            nums  add_1_arg; //structure variable

#ifndef     DEBUG
            clnt = clnt_create (host, sum_prog, sum_ver, "udp");
            if (clnt == NULL) {
                        clnt_pcreateerror (host);
                        exit (1);
```

```
        }
        /*ASK USER TO ENTER TWO NUMBERS*/
        printf("\nEnter 2 numbers to add : ");
        scanf("%d%d",&add_1_arg.a,&add_1_arg.b);
#endif  /* DEBUG */
        result_1=(int*)malloc(sizeof(int));
        result_1 = add_1(&add_1_arg, clnt);
        if (result_1 == (int *) NULL) {
                clnt_perror (clnt, "call failed");

        }
        printf("\nSum of %d\t%d\t is %d\n",add_1_arg.a,add_1_arg.b,*result_1);
#ifndef DEBUG
        clnt_destroy (clnt);
#endif   /* DEBUG */
}


int
main (int argc, char *argv[])
{
        char *host;

        if (argc < 2) {
                printf ("usage: %s server_host\n", argv[0]);
                exit (1);
        }
        host = argv[1];
        sum_prog_1 (host);
exit (0);
}
/*addition_clnt.c*/
/*
 * Please do not edit this file.
 * It was generated using rpcgen.
 */
```

```
#include <memory.h> /* for memset */
#include "addition.h"

/* Default timeout can be changed using clnt_control() */
static struct timeval TIMEOUT = { 25, 0 };

int *
add_1(nums *argp, CLIENT *clnt)
{
	static int clnt_res;

	memset((char *)&clnt_res, 0, sizeof(clnt_res));
	if (clnt_call (clnt, add,
		(xdrproc_t) xdr_nums, (caddr_t) argp,
		(xdrproc_t) xdr_int, (caddr_t) &clnt_res,
		TIMEOUT) != RPC_SUCCESS) {
		return (NULL);
	}
	return (&clnt_res);
}
/*addition_server.c*/
/*
 * This is sample code generated by rpcgen.
 * These are only templates and you can use them
 * as a guideline for developing your own functions.
 */

#include "addition.h"

int *
add_1_svc(nums *argp, struct svc_req *rqstp)
{
	static int  result;
	result=argp->a+argp->b;
	return &result;
```

```
}
/*addition_svc.c*/
/*
 * Please do not edit this file.
 * It was generated using rpcgen.
 */

#include "addition.h"
#include <stdio.h>
#include <stdlib.h>
#include <rpc/pmap_clnt.h>
#include <string.h>
#include <memory.h>
#include <sys/socket.h>
#include <netinet/in.h>

#ifndef SIG_PF
#define SIG_PF void(*)(int)
#endif

static void
sum_prog_1(struct svc_req *rqstp, register SVCXPRT *transp)
{
	union {
		nums add_1_arg;
	} argument;
	char *result;
	xdrproc_t _xdr_argument, _xdr_result;
	char *(*local)(char *, struct svc_req *);

	switch (rqstp->rq_proc) {
	case NULLPROC:
		(void) svc_sendreply (transp, (xdrproc_t) xdr_void, (char *)NULL);
		return;

	case add:
```

```
		_xdr_argument = (xdrproc_t) xdr_nums;
		_xdr_result = (xdrproc_t) xdr_int;
		local = (char *(*)(char *, struct svc_req *)) add_1_svc;
		break;

	default:
		svcerr_noproc (transp);
		return;
	}
	memset ((char *)&argument, 0, sizeof (argument));
	if (!svc_getargs (transp, (xdrproc_t) _xdr_argument, (caddr_t) &argument)) {
		svcerr_decode (transp);
		return;
	}
	result = (*local)((char *)&argument, rqstp);
	if (result != NULL && !svc_sendreply(transp, (xdrproc_t) _xdr_result, result)) {
		svcerr_systemerr (transp);
	}
	if (!svc_freeargs (transp, (xdrproc_t) _xdr_argument, (caddr_t) &argument)) {
		fprintf (stderr, "%s", "unable to free arguments");
		exit (1);
	}
	return;
}

int
main (int argc, char **argv)
{
	register SVCXPRT *transp;

	pmap_unset (sum_prog, sum_ver);

	transp = svcudp_create(RPC_ANYSOCK);
	if (transp == NULL) {
		fprintf (stderr, "%s", "cannot create udp service.");
		exit(1);
	}
```

```
	if (!svc_register(transp, sum_prog, sum_ver, sum_prog_1, IPPROTO_UDP)) {
		fprintf (stderr, "%s", "unable to register (sum_prog, sum_ver, udp).");
		exit(1);
	}

	transp = svctcp_create(RPC_ANYSOCK, 0, 0);
	if (transp == NULL) {
		fprintf (stderr, "%s", "cannot create tcp service.");
		exit(1);
	}
	if (!svc_register(transp, sum_prog, sum_ver, sum_prog_1, IPPROTO_TCP)) {
		fprintf (stderr, "%s", "unable to register (sum_prog, sum_ver, tcp).");
		exit(1);
	}

	svc_run ();
	fprintf (stderr, "%s", "svc_run returned");
	exit (1);
	/* NOTREACHED */
}



/*addition_xdr.c*/

/*
 * Please do not edit this file.
 * It was generated using rpcgen.
 */

#include "addition.h"

bool_t
xdr_nums (XDR *xdrs, nums *objp)
{
	register int32_t *buf;
```

```
        if (!xdr_int (xdrs, &objp->a))
                return FALSE;
        if (!xdr_int (xdrs, &objp->b))
                return FALSE;
        return TRUE;
}
/*addition.h*/
/*
 * Please do not edit this file.
 * It was generated using rpcgen.
 */

#ifndef _ADDITION_H_RPCGEN
#define _ADDITION_H_RPCGEN

#include <rpc/rpc.h>


#ifdef __cplusplus
extern "C" {
#endif


struct nums {
        int a;
        int b;
};
typedef struct nums nums;

#define sum_prog 0x20001080
#define sum_ver 1

#if defined(__STDC__) || defined(__cplusplus)
#define add 1
extern  int * add_1(nums *, CLIENT *);
extern  int * add_1_svc(nums *, struct svc_req *);
```

```
extern int sum_prog_1_freeresult (SVCXPRT *, xdrproc_t, caddr_t);

#else /* K&R C */
#define add 1
extern  int * add_1();
extern  int * add_1_svc();
extern int sum_prog_1_freeresult ();
#endif /* K&R C */

/* the xdr functions */

#if defined(__STDC__) || defined(__cplusplus)
extern  bool_t xdr_nums (XDR *, nums*);

#else /* K&R C */
extern bool_t xdr_nums ();

#endif /* K&R C */

#ifdef __cplusplus
}
#endif

#endif /* !_ADDITION_H_RPCGEN */
/*Makefile.addition*/


# This is a template Makefile generated by rpcgen


# Parameters


CLIENT = addition_client
SERVER = addition_server


SOURCES_CLNT.c =
```

```
SOURCES_CLNT.h =

SOURCES_SVC.c =

SOURCES_SVC.h =

SOURCES.x = addition.x


TARGETS_SVC.c = addition_svc.c addition_server.c addition_xdr.c

TARGETS_CLNT.c = addition_clnt.c addition_client.c addition_xdr.c

TARGETS = addition.h addition_xdr.c addition_clnt.c addition_svc.c addition_client.c
addition_server.c


OBJECTS_CLNT = $(SOURCES_CLNT.c:%.c=%.o) $(TARGETS_CLNT.c:%.c=%.o)

OBJECTS_SVC = $(SOURCES_SVC.c:%.c=%.o) $(TARGETS_SVC.c:%.c=%.o)

# Compiler flags


CFLAGS += -g

LDLIBS += -lnsl

RPCGENFLAGS =


# Targets


all : $(CLIENT) $(SERVER)


$(TARGETS) : $(SOURCES.x)

	rpcgen $(RPCGENFLAGS) $(SOURCES.x)


$(OBJECTS_CLNT) : $(SOURCES_CLNT.c) $(SOURCES_CLNT.h) $(TARGETS_CLNT.c)


$(OBJECTS_SVC) : $(SOURCES_SVC.c) $(SOURCES_SVC.h) $(TARGETS_SVC.c)
```

```
$(CLIENT) : $(OBJECTS_CLNT)
	$(LINK.c) -o $(CLIENT) $(OBJECTS_CLNT) $(LDLIBS)


$(SERVER) : $(OBJECTS_SVC)
	$(LINK.c) -o $(SERVER) $(OBJECTS_SVC) $(LDLIBS)


clean:
	$(RM) core $(TARGETS) $(OBJECTS_CLNT) $(OBJECTS_SVC) $(CLIENT) $(SERVER)
```

<u>OUTPUT</u>:

Compilation : rpcgen –a addition.x (generates the files)

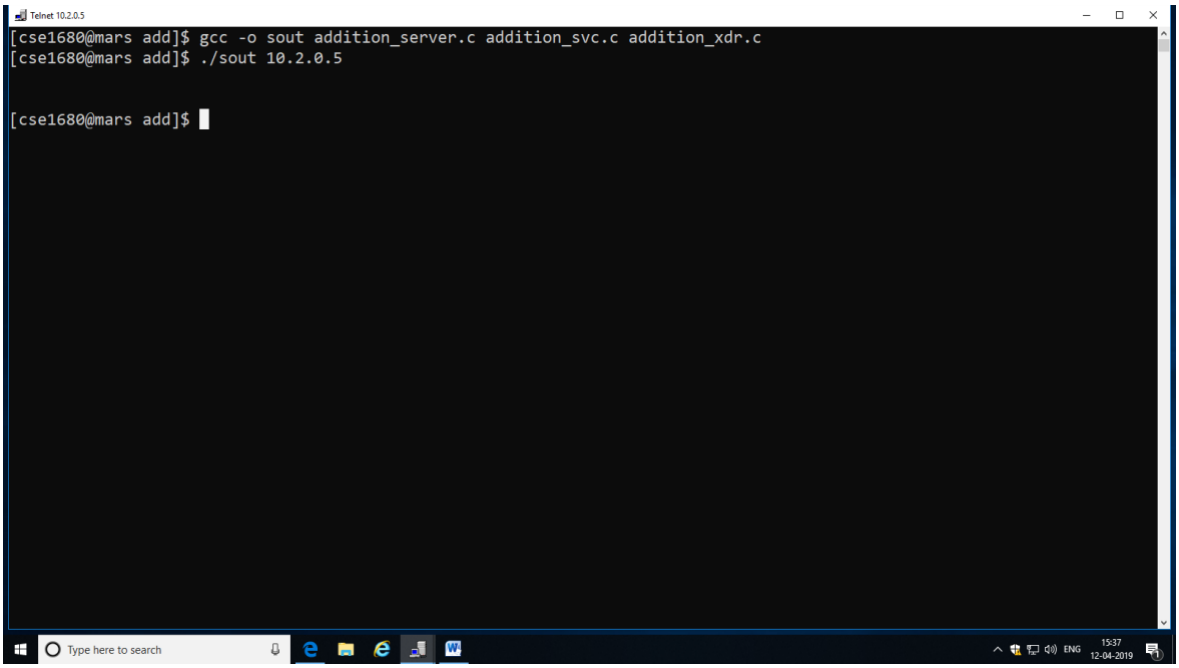
gcc –o cout addition_client.c addition_clnt.c addition_xdr.c

gcc –o sout addition_server.c addition_svc.c addition_xdr.c

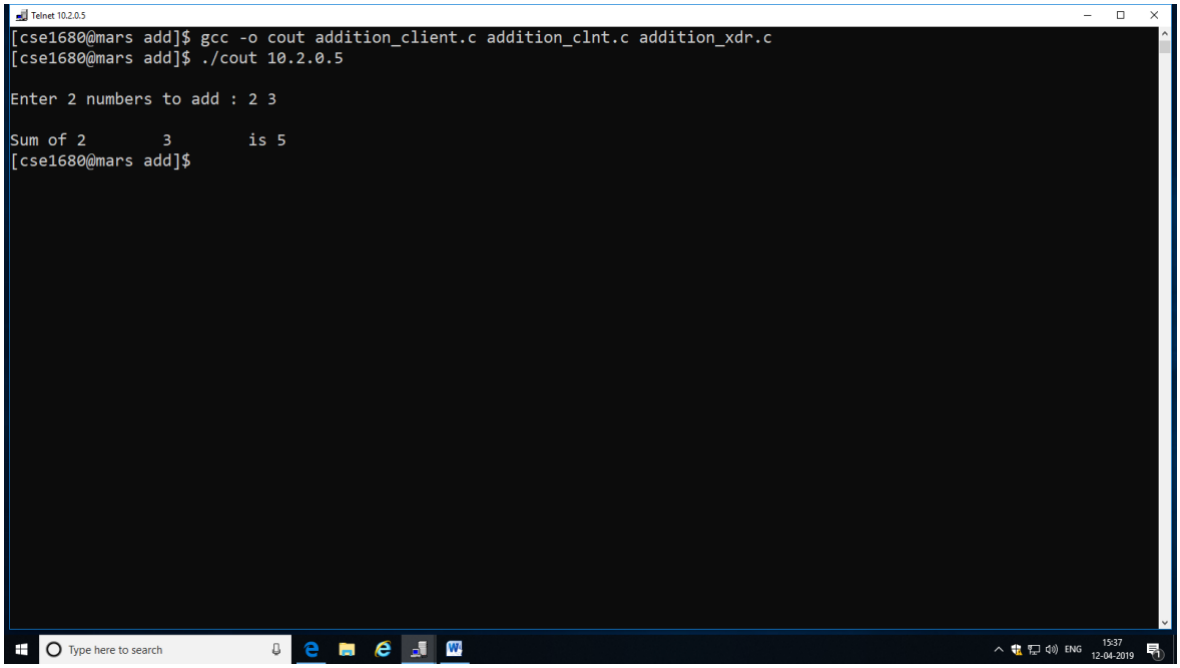
Execution : ./sout 10.2.0.5 (Execute in a separate terminal window first)

./cout 10.2.0.5 (Execute in a separate terminal window second)

SERVER



CLIENT



RPC(REMOTE PROCEDURE CALL) : SENDING/RESPONDING TO MESSAGE

Program:

```
/*message.x*/


program msg_prog{
version msg_ver{
        string message()=1;
        }=1;
        }=0x20000080;
/*message_client.c*/
/*
 * This is sample code generated by rpcgen.
 * These are only templates and you can use them
 * as a guideline for developing your own functions.
 */

#include "message.h"



void
msg_prog_1(char *host)
{
        CLIENT *clnt;
        char * *result_1;
        char *message_1_arg;

#ifndef DEBUG
        clnt = clnt_create (host, msg_prog, msg_ver, "udp");
        if (clnt == NULL) {
                clnt_pcreateerror (host);
                exit (1);
        }
#endif  /* DEBUG */
        *result_1=(char*)malloc(sizeof(char)*30);
        result_1 = message_1((void*)&message_1_arg, clnt);
```

```
        if (result_1 == (char **) NULL) {
                clnt_perror (clnt, "call failed");
        }
        else
                printf("\nRPC Server Response is %s\n",*result_1);
#ifndef DEBUG
        clnt_destroy (clnt);
#endif  /* DEBUG */
}


int
main (int argc, char *argv[])
{
        char *host;

        if (argc < 2) {
                printf ("usage: %s server_host\n", argv[0]);
                exit (1);
        }
        host = argv[1];
        msg_prog_1 (host);
exit (0);
}

/*message_clnt.c*/
/*
 * Please do not edit this file.
 * It was generated using rpcgen.
 */

#include <memory.h> /* for memset */
#include "message.h"

/* Default timeout can be changed using clnt_control() */
static struct timeval TIMEOUT = { 25, 0 };
```

```
char **
message_1(void *argp, CLIENT *clnt)
{
	static char *clnt_res;

	memset((char *)&clnt_res, 0, sizeof(clnt_res));
	if (clnt_call (clnt, message,
		(xdrproc_t) xdr_void, (caddr_t) argp,
		(xdrproc_t) xdr_wrapstring, (caddr_t) &clnt_res,
		TIMEOUT) != RPC_SUCCESS) {
		return (NULL);
	}
	return (&clnt_res);
}
/*message_server.c*/
/*
 * This is sample code generated by rpcgen.
 * These are only templates and you can use them
 * as a guideline for developing your own functions.
 */

#include "message.h"
#include<string.h>

char **
message_1_svc(void *argp, struct svc_req *rqstp)
{
	static char * result;
	result=(char*)malloc(sizeof(char)*30);
	strcpy(result,"Hello-Response from RPC Server");
	return &result;
}
/*message_svc.c*/
/*
 * Please do not edit this file.
```

```
 * It was generated using rpcgen.
 */

#include "message.h"
#include <stdio.h>
#include <stdlib.h>
#include <rpc/pmap_clnt.h>
#include <string.h>
#include <memory.h>
#include <sys/socket.h>
#include <netinet/in.h>

#ifndef SIG_PF
#define SIG_PF void(*)(int)
#endif

static void
msg_prog_1(struct svc_req *rqstp, register SVCXPRT *transp)
{
	union {
		int fill;
	} argument;
	char *result;
	xdrproc_t _xdr_argument, _xdr_result;
	char *(*local)(char *, struct svc_req *);

	switch (rqstp->rq_proc) {
	case NULLPROC:
		(void) svc_sendreply (transp, (xdrproc_t) xdr_void, (char *)NULL);
		return;

	case message:
		_xdr_argument = (xdrproc_t) xdr_void;
		_xdr_result = (xdrproc_t) xdr_wrapstring;
		local = (char *(*)(char *, struct svc_req *)) message_1_svc;
		break;
```

```
	default:
		svcerr_noproc (transp);
		return;
	}
	memset ((char *)&argument, 0, sizeof (argument));
	if (!svc_getargs (transp, (xdrproc_t) _xdr_argument, (caddr_t) &argument)) {
		svcerr_decode (transp);
		return;
	}
	result = (*local)((char *)&argument, rqstp);
	if (result != NULL && !svc_sendreply(transp, (xdrproc_t) _xdr_result, result)) {
		svcerr_systemerr (transp);
	}
	if (!svc_freeargs (transp, (xdrproc_t) _xdr_argument, (caddr_t) &argument)) {
		fprintf (stderr, "%s", "unable to free arguments");
		exit (1);
	}
	return;
}

int
main (int argc, char **argv)
{
	register SVCXPRT *transp;

	pmap_unset (msg_prog, msg_ver);

	transp = svcudp_create(RPC_ANYSOCK);
	if (transp == NULL) {
		fprintf (stderr, "%s", "cannot create udp service.");
		exit(1);
	}
	if (!svc_register(transp, msg_prog, msg_ver, msg_prog_1, IPPROTO_UDP)) {
		fprintf (stderr, "%s", "unable to register (msg_prog, msg_ver, udp).");
		exit(1);
	}
```

```
	transp = svctcp_create(RPC_ANYSOCK, 0, 0);
	if (transp == NULL) {
		fprintf (stderr, "%s", "cannot create tcp service.");
		exit(1);
	}
	if (!svc_register(transp, msg_prog, msg_ver, msg_prog_1, IPPROTO_TCP)) {
		fprintf (stderr, "%s", "unable to register (msg_prog, msg_ver, tcp).");
		exit(1);
	}

	svc_run ();
	fprintf (stderr, "%s", "svc_run returned");
	exit (1);
	/* NOTREACHED */
}
/*message.h*/
/*
 * Please do not edit this file.
 * It was generated using rpcgen.
 */

#ifndef _MESSAGE_H_RPCGEN
#define _MESSAGE_H_RPCGEN

#include <rpc/rpc.h>



#ifdef __cplusplus
extern "C" {
#endif



#define msg_prog 0x20000080
#define msg_ver 1

#if defined(__STDC__) || defined(__cplusplus)
#define message 1
```

```
extern  char ** message_1(void *, CLIENT *);
extern  char ** message_1_svc(void *, struct svc_req *);
extern int msg_prog_1_freeresult (SVCXPRT *, xdrproc_t, caddr_t);

#else /* K&R C */
#define message 1
extern  char ** message_1();
extern  char ** message_1_svc();
extern int msg_prog_1_freeresult ();
#endif /* K&R C */

#ifdef __cplusplus
}
#endif

#endif /* !_MESSAGE_H_RPCGEN */
```

```
/*Makefile.message*/

# This is a template Makefile generated by rpcgen

# Parameters

CLIENT = message_client
SERVER = message_server

SOURCES_CLNT.c =
SOURCES_CLNT.h =
SOURCES_SVC.c =
SOURCES_SVC.h =
SOURCES.x = message.x
```

```
TARGETS_SVC.c = message_svc.c message_server.c

TARGETS_CLNT.c = message_clnt.c message_client.c

TARGETS = message.h   message_clnt.c message_svc.c message_client.c message_server.c


OBJECTS_CLNT = $(SOURCES_CLNT.c:%.c=%.o) $(TARGETS_CLNT.c:%.c=%.o)

OBJECTS_SVC = $(SOURCES_SVC.c:%.c=%.o) $(TARGETS_SVC.c:%.c=%.o)

# Compiler flags


CFLAGS += -g

LDLIBS += -lnsl

RPCGENFLAGS =


# Targets


all : $(CLIENT) $(SERVER)


$(TARGETS) : $(SOURCES.x)

	rpcgen $(RPCGENFLAGS) $(SOURCES.x)


$(OBJECTS_CLNT) : $(SOURCES_CLNT.c) $(SOURCES_CLNT.h) $(TARGETS_CLNT.c)


$(OBJECTS_SVC) : $(SOURCES_SVC.c) $(SOURCES_SVC.h) $(TARGETS_SVC.c)


$(CLIENT) : $(OBJECTS_CLNT)

	$(LINK.c) -o $(CLIENT) $(OBJECTS_CLNT) $(LDLIBS)


$(SERVER) : $(OBJECTS_SVC)
```

```
	$(LINK.c) -o $(SERVER) $(OBJECTS_SVC) $(LDLIBS)


clean:

	$(RM) core $(TARGETS) $(OBJECTS_CLNT) $(OBJECTS_SVC) $(CLIENT)
$(SERVER)
```

<u>OUTPUT</u>:

Compilation : rpcgen –a message.x (generates the files)

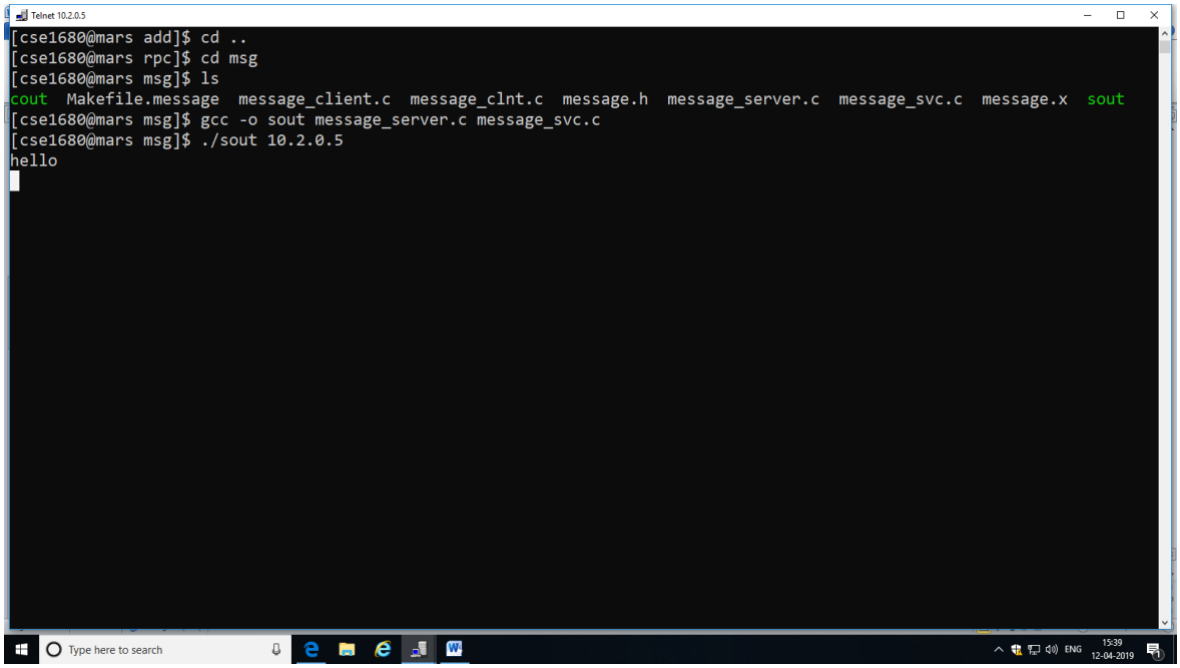
gcc –o cout message_client.c message_clnt.c

gcc –o sout message_server.c message_svc.c

Execution : ./sout 10.2.0.5 (Execute in a separate terminal window and first)

./cout 10.2.0.5 (Execute in a separate terminal window and second)

SERVER



CLIENT