Lab - 09

P2P Network Using IPC

Program: MScIT

Sem-2

Group ID : 28

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Client.c

```
#include <netdb.h>
#include <stdlib.h>
#include <sys/types.h>
#include <stdio.h>
#include <unistd.h>
#include <string.h>
#include <sys/socket.h>
#include <sys/ioctl.h>
#include <netinet/in.h>
#include <net/if.h>
#include <arpa/inet.h>
#include <wait.h>
#include <signal.h>
#define PORT 8080

char server_ip[20] = "10.0.2.14";
char ip_address[20];
int readPipe;
int writePipe;

struct req{
        char type[1];
        char data[1024];
        char filename[20];
        int save;
};

struct nodeList{
        char nodes[5][15];
};

struct interProcComm{
        char type[1];
        char data[1024];
        struct nodeList nl;
        int childPID;
};

struct manifest{
        char chunk_IP[5][2][15];
};


void getIP(){
        system("ifconfig | grep 'inet ' | sed -n '1 p' | awk '{print $2}' > ip.txt");
        FILE * f = fopen("ip.txt","r");
        fgets(ip_address,15,f);
}

void comm(int sockfd,int pipeSend,int pipeRecv){

        sendIP(sockfd);
        printf("Sent my IP\n");
        int i;
        scanf("%d",&i);

        struct manifest man;
        memset(&man,0,sizeof(struct manifest));
        getManifestData(sockfd,&man);

        for(int i=0;i<5;i++){
        printf("filename :%s IP:%s\n",man.chunk_IP[i][0],
        man.chunk_IP[i][1]);
        }

        scanf("%d",&i);
        getChunkFiles(sockfd,&man);


}

void sendIP(int sockfd){
        struct req req;

        memset(&req,0,sizeof(struct req));

        req.type[0]='1';

        strcpy(req.data,ip_address);

        send(sockfd,&req,sizeof(struct req),0);
}


void gtValidNodes(int sockfd,int pipeSend,int pipeRecv){
        struct req req;
        struct nodeList nl;

        memset(&nl,0,sizeof(nl));
        memset(&req,0,sizeof(struct req));
        req.type[0]='2';

        send(sockfd,&req,sizeof(struct req),0);
        recv(sockfd,&nl,sizeof(struct nodeList),0);

        for(int i=0;i<5;i++){
        printf("IP [%d] : %s\n",i,nl.nodes[i]);
        }
        sendNodeListToParent(&nl,pipeSend,pipeRecv);
}

void getManifestData(int sockfd,struct manifest * man){
        struct req req;
        memset(&req,0,sizeof(struct req));

        req.type[0]='3';

        send(sockfd,&req,sizeof(struct req),0);
        recv(sockfd,man,sizeof(struct manifest),0);
}

void getChunkFiles(int sockfd,struct manifest * man){
        int count=0;
        int status;
        for(int i=0;i<5;i++){
        if(strlen(man->chunk_IP[i][1])==0)break;
        count++;
        if((fork())==0){
        printf("trying to get file:%s\n",man->chunk_IP[i][0]);
        clientSegmentForChunk(man->chunk_IP[i][1],man->chunk_IP[i][0]);
        }
        wait(&status);
        }
}

void sendNodeListToParent(struct nodeList *nl,int pipeSend,int pipeRecv){
        kill(getppid(),SIGUSR1);
        struct interProcComm interProcComm;
        interProcComm.type[0]='1';

        for(int i=0;i<5;i++){
        strcpy(interProcComm.nl.nodes[i],nl->nodes[i]);
        }

        write(pipeSend,&interProcComm,sizeof(struct interProcComm));
        exit(0);
```

```
}

void clientSegmentForChunk(char * server_ip,char * filename){
        int sockfd;
        struct sockaddr_in address;
        sockfd=socket(AF_INET,SOCK_STREAM,0);
        if(sockfd == -1){
        printf("Error while creating socket\n");
        exit(0);
        }
        memset(&address,0,sizeof(address));
        address.sin_family = AF_INET;
        address.sin_port = htons(PORT);
        address.sin_addr.s_addr = inet_addr(server_ip);

        if((connect(sockfd,(struct sockaddr*)&address,sizeof(address)))!=0){
        printf("Connection with server failed.\n");
        exit(0);
        }
        printf("Connection with server established\n");


        struct req req,req1;
        memset(&req,0,sizeof(struct req));
        req.type[0]='4';

        strcpy(req.filename,filename);

        send(sockfd,&req,sizeof(struct req),0);

        memset(&req1,0,sizeof(struct req));
        recv(sockfd,&req1,sizeof(struct req),0);

        FILE * f = fopen("dev_saif.txt","a");
        printf("-----------\ndata from %s : %s\n---------\n",filename,req1.data);

        fprintf(f,"%s",req1.data);
        fclose(f);


        if(req1.save==1){
        char * temp = "test.p2p";
        FILE * chunk = fopen(temp,"w");
        fprintf(chunk,"%s",req1.data);
        fclose(chunk);
        struct req manReq;
        memset(&manReq,0,sizeof(struct req));

        manReq.type[0]='5';
        strcpy(manReq.filename,filename);
        strcpy(manReq.data,ip_address);
        printf("sent req to update manifest data\n");
        send(sockfd,&manReq,sizeof(struct req),0);

        }
        exit(0);
}

void clientSegment(char * server_ip,int pipeSend,int pipeRecv){
        int sockfd;
        struct sockaddr_in address;

        sockfd=socket(AF_INET,SOCK_STREAM,0);
        if(sockfd == -1){
        printf("Error while creating socket\n");
        exit(0);
        }
        memset(&address,0,sizeof(address));
        address.sin_family = AF_INET;
        address.sin_port = htons(PORT);
        address.sin_addr.s_addr = inet_addr(server_ip);

        if((connect(sockfd,(struct sockaddr*)&address,sizeof(address)))!=0){
        printf("Connection with server failed.\n");
        exit(0);
        }
        printf("Connection with server established\n");
        comm(sockfd,pipeSend,pipeRecv);
}

void signalHandler(int sig){
        struct interProcComm interProcComm;
        memset(&interProcComm,0,sizeof(struct interProcComm));
        read(readPipe,&interProcComm,sizeof(struct interProcComm));

        switch(interProcComm.type[0]){
        case '1':startNewConnection(&interProcComm);break;
        }
}
```

```
void startNewConnection(struct interProcComm *interProcComm){
        strcpy(server_ip,interProcComm->nl.nodes[0]);
}

int main(){
        int pipe1[2];
        int pipe2[2];

        pipe(pipe1);
        pipe(pipe2);
        readPipe = pipe1[0];
        writePipe = pipe2[0];
        int status;
        getIP();
        printf("My IP: %s",ip_address);

        signal(SIGUSR1,signalHandler);
        while(1){
        if(fork()==0){
        printf("Connecting with server of IP: %s\n",server_ip);
        clientSegment(server_ip,pipe1[1],pipe2[0]);
        }
        wait(&status);
        }
}
```

Server.c

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

#define PORT 8080

char clients[5][20];
int top=1;
int readPipe;
int writePipe;
char ipaddr[20];


struct request{
	char type[1];
	char data[1024];
	char filename[20];
	int save;
};

struct clientIP{
	int index;
	char IP[15];
};

struct nodeList{
	char nodes[5][15];
};

struct IPC{
	char type[1];
	char data[1024];
	char IP[15];
	char filename[15];
	struct clientIP cip;
	struct nodeList nl;
};
```

```
struct manifest{
        char chunk_IP[5][2][15];
};

struct manifest MAN;


void getIP(){
        system("ifconfig | grep 'inet ' | sed -n '2 p' | awk '{print $2}' > serverip.txt");
        FILE * f = fopen("serverip.txt","r");
        fgets(ipaddr,15,f);
}


void distributeFile(){

        FILE *f = fopen("data.txt","r");

        int count;
        char c;

        for (c = getc(f); c != EOF; c = getc(f)) count = count + 1;

        fclose(f);
        int devide = (count / 4)+1;
        FILE * fd = fopen("data.txt","r");
        char msg[1024];
        for(int i=0; fgets(msg, devide, fd) != NULL ;i++){

        if (i==3){
        memset(msg,0,1024);
        fgets(msg,devide,fd);
        }

        char filename[20];
        sprintf(filename,"chunk%d.p2p",i);
        FILE * nf = fopen(filename,"w");
        fprintf(nf,"%s",msg);


        strcpy(MAN.chunk_IP[i][0],filename);
        strcpy(MAN.chunk_IP[i][1],ipaddr);


        fclose(nf);
        memset(msg,0,1024);
        }
        for(int i=0;i<5;i++){
        printf("filename :%s IP:%s\n",MAN.chunk_IP[i][0],
        MAN.chunk_IP[i][1]);
        }
}

void communicate(int client,int pipeSend,int pipeRecv,int index){
        int cont=1;
        while(cont == 1){
        struct request req;
        memset(&req,0,sizeof(struct request));

        recv(client,&req,sizeof(struct request),0);
        int con = (int)req.type[0];
        if(con == 0) continue;
        cont = handleClientRequest(&req,client,pipeSend,pipeRecv,index);
        }
        printf("exited\n");
        exit(0);
}

int handleClientRequest(struct request * req,int client,
int pipeSend,int pipeRecv,int index){

        switch(req->type[0]){
        case '1':recvClientIP(req,pipeSend,pipeRecv,index);break;
        case '2':getClientsIP(client,req,pipeSend,pipeRecv);break;
        case '3':sendManifestData(client);break;
        case '4':sendChunkFile(client,req);break;
        case '5':updateManifest(client,req,pipeSend,pipeRecv);break;
        case '6':printf("close connection.\n");return 0;
        default:printf("Invalid request from client.\n");
        }
        return 1;
}

void recvClientIP(struct request * req,int pipeSend,int pipeRecv,int index){
        printf("Connection established with client of IP %s",req->data);

        struct flock fl;
        fl.l_type = F_WRLCK;
        fl.l_whence = SEEK_SET;
        fl.l_start = 0;
        fl.l_len = 0;
```

```
	fl.l_pid = getpid();


	fcntl(pipeSend,F_SETLK,&fl);

	kill(getppid(),SIGUSR1);

	struct IPC ipc;
	memset(&ipc,0,sizeof(struct IPC));

	ipc.type[0]='1';

	ipc.cip.index = index;

	strcpy(ipc.cip.IP,req->data);

	write(pipeSend,&ipc,sizeof(struct IPC));

	fl.l_type = F_UNLCK;
	fcntl(pipeSend,F_SETLK,&fl);
	printf("Done\n");
}

void getClientsIP(int client,struct reuqest * req,int pipeSend,int pipeRecv){
	struct flock fl;
	fl.l_type = F_WRLCK;
	fl.l_whence = SEEK_SET;
	fl.l_start = 0;
	fl.l_len = 0;
	fl.l_pid = getpid();


	fcntl(pipeSend,F_SETLK,&fl);

	kill(getppid(),SIGUSR1);

	struct IPC ipc;
	memset(&ipc,0,sizeof(struct IPC));

	ipc.type[0]='2';

	struct nodeList nl;
	memset(&nl,0,sizeof(struct nodeList));

	write(pipeSend,&ipc,sizeof(struct IPC));
```

```
        memset(&ipc,0,sizeof(struct IPC));

        read(pipeRecv,&nl,sizeof(struct nodeList));

        for(int i=0;i<5;i++){
        printf("IP [%d] : %s",i,nl.nodes[i]);
        }

        fl.l_type = F_UNLCK;
        fcntl(pipeSend,F_SETLK,&fl);
        send(client,&nl,sizeof(struct nodeList),0);
        printf("Done2\n");
}

void sendManifestData(int client){
        send(client,&MAN,sizeof(struct manifest),0);
}

void sendChunkFile(int client,struct request * req){

        struct request newReq;
        char data[1024];
        memset(&newReq,0,sizeof(struct request));

        FILE * f = fopen(req->filename,"r");

        fgets(data,1024,f);
        if(strncmp("chunk0.p2p",req->filename,10) == 0){
        newReq.save = 1;
        printf("====\nsave\n====\n");
        }
        strcpy(newReq.data,data);
        printf("data: %s\n",newReq.data);
        send(client,&newReq,sizeof(struct request),0);

        printf("Sent file\n");
        fclose(f);
}

void updateManifest(int client,struct request * req,int pipeSend,int pipeRecv){
        printf("Updating manifest for file: %s with IP: %s",req->filename,req->data);

        struct flock fl;
        fl.l_type = F_WRLCK;
        fl.l_whence = SEEK_SET;
        fl.l_start = 0;
        fl.l_len = 0;
        fl.l_pid = getpid();

        fcntl(pipeSend,F_SETLK,&fl);

        kill(getppid(),SIGUSR1);

        struct IPC ipc;
        memset(&ipc,0,sizeof(struct IPC));
        ipc.type[0] = '3';
        strcpy(ipc.filename,req->filename);
        strcpy(ipc.IP,req->data);

        write(pipeSend,&ipc,sizeof(struct IPC));

        fl.l_type = F_UNLCK;
        fcntl(pipeSend,F_SETFL,&fl);
        printf("Manifest Updated\n");

}

void signalHandler(int sig){
        struct IPC ipc;
        memset(&ipc,0,sizeof(struct IPC));
        read(readPipe,&ipc,sizeof(struct IPC));

        switch(ipc.type[0]){
        case '1':recvIP(&ipc);break;
        case '2':sendIPS(&ipc);break;
        case '3':recvManifestData(&ipc);break;
        }
}

void recvIP(struct IPC * ipc){
        printf("Called the signal: %s\n",ipc->cip.IP);
        strcpy(clients[ipc->cip.index],ipc->cip.IP);
        displayClientIPS();
}

void sendIPS(struct IPC * ipc){
        printf("Called the signal\n");
        struct nodeList nl;
        memset(&nl,0,sizeof(struct nodeList));

        for(int i=0;i<5;i++){
        strcpy(nl.nodes[i],clients[i]);
        }
        write(writePipe,&nl,sizeof(struct nodeList));
}

void recvManifestData(struct IPC * ipc){
        printf("Called the signal\n");
        for(int i=0;i<5;i++){
        if( strcmp(MAN.chunk_IP[i][0],ipc->filename)==0){
        strcpy(MAN.chunk_IP[i][1],ipc->IP);
        break;
        }
        }
}

void displayClientIPS(){
        for(int i=0;i<5;i++){
        printf("client [%d] : %s\n",i,clients[i]);
        }
}

int main(){
        int pipes1[2];
        int pipes2[2];

        pipe(pipes1);
        pipe(pipes2);
        readPipe = pipes1[0];
        writePipe = pipes2[1];

        int sockfd,length;
        struct sockaddr_in address;

        getIP();
        distributeFile();

        sockfd = socket(AF_INET,SOCK_STREAM,0);
        if(sockfd == -1){
        printf("Error while creating socket\n");
        exit(0);
        }

        printf("Socket created successfully\n");

        memset(&address,0,sizeof(address));
        address.sin_family = AF_INET;
        address.sin_port = htons(PORT);
        address.sin_addr.s_addr = htonl(INADDR_ANY);


        if( (bind(sockfd,(struct sockaddr*)&address,sizeof(address)))!=0){
        printf("Error while binding socket.\n");
        exit(0);
        }

        printf("Binded socket\n");

        if((listen(sockfd,5))!=0){
        printf("Error while listening.\n");
        exit(0);
        }
        printf("Listening...\n");

        signal(SIGUSR1,signalHandler);
        while(1){
        for(int i=0;i<5;i++){
        length = sizeof(address);
        int client = accept(sockfd,(struct sockaddr*)&address,&length);
        if(fork()==0){

                communicate(client,pipes1[1],pipes2[0],i);
        }
        top++;
        }
        }
}
```

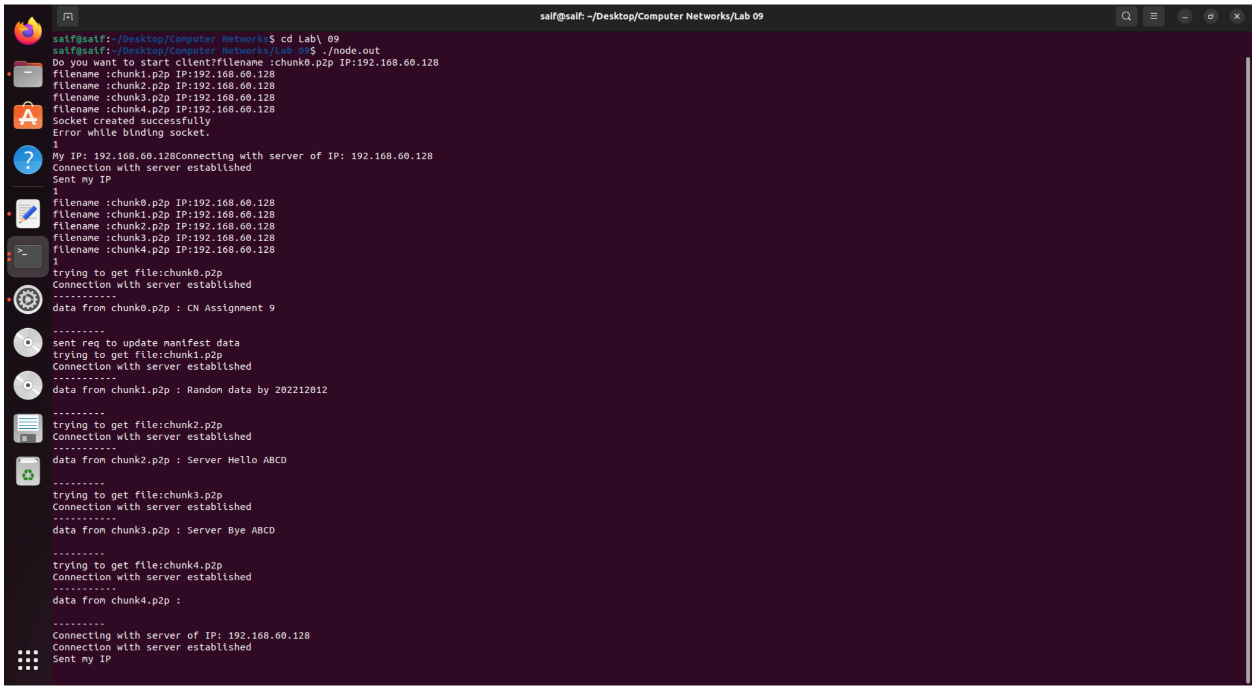
Node.c

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

int main(){
        int sp1[2];
        int sp2[2];

        int cp1[2];
        int cp2[2];


        pipe(sp1);
        pipe(sp2);

        pipe(cp1);
        pipe(cp2);

        if(fork()==0){
        char spipe1[5];
        char spipe2[5];


        sprintf(spipe1,"%d",sp1[1]);
        sprintf(spipe2,"%d",sp2[0]);


        execl("./server.out","server.out",spipe1,spipe2,NULL);
        printf("Failed to start server child process\n");
        exit(1);
        }
        int t;
        printf("Do you want to start client?");
        scanf("%d",&t);
        if(fork()==0){
        char cpipe1[5];
        char cpipe2[5];

        sprintf(cpipe1,"%d",cp1[1]);
        sprintf(cpipe2,"%d",cp2[0]);
        char *arguments[]={"./client.out",cpipe1,cpipe2,NULL};


        execl("./client.out","client.out",cpipe1,cpipe2,NULL);
        printf("Failed to start client child process\n");
        exit(1);
        }
        int statusServer,statusClient;
        pid_t pid1,pid2;
        pid1 = wait(&statusServer);
        pid2 = wait(&statusClient);
}
```

Data.txt

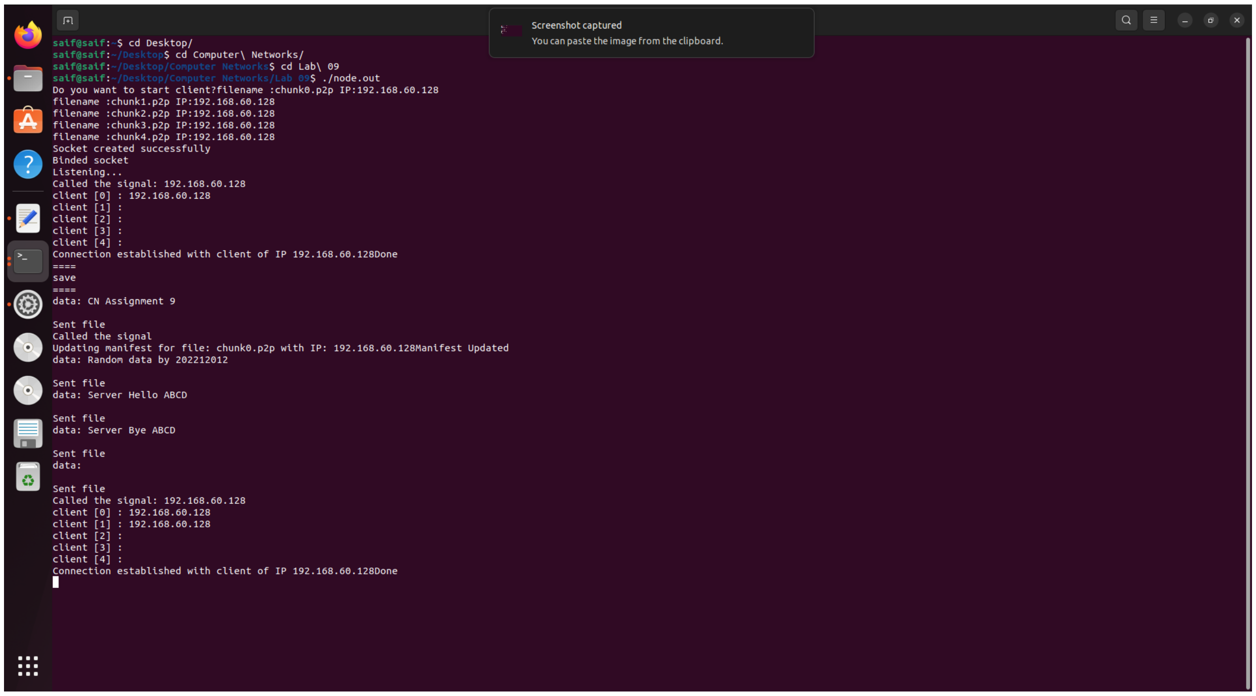
```
CN Assignment 9
Random data by 202212012
Server Hello ABCD
Random data by 202212083
Server Bye ABCD
```

Screenshots:



saif@saif: ~/Desktop/Computer Networks/Lab 09

```
saif@saif:~/Desktop/Computer Networks$ cd Lab\ 09
saif@saif:~/Desktop/Computer Networks/Lab 09$ ./node.out
Do you want to start client?filename :chunk0.p2p IP:192.168.60.128
filename :chunk1.p2p IP:192.168.60.128
filename :chunk2.p2p IP:192.168.60.128
filename :chunk3.p2p IP:192.168.60.128
filename :chunk4.p2p IP:192.168.60.128
Socket created successfully
Error while binding socket.
1
My IP: 192.168.60.128Connecting with server of IP: 192.168.60.128
Connection with server established
Sent my IP
1
filename :chunk0.p2p IP:192.168.60.128
filename :chunk1.p2p IP:192.168.60.128
filename :chunk2.p2p IP:192.168.60.128
filename :chunk3.p2p IP:192.168.60.128
filename :chunk4.p2p IP:192.168.60.128
1
trying to get file:chunk0.p2p
Connection with server established
-----------
data from chunk0.p2p : CN Assignment 9

---------
sent req to update manifest data
trying to get file:chunk1.p2p
Connection with server established
-----------
data from chunk1.p2p : Random data by 202212012

---------
trying to get file:chunk2.p2p
Connection with server established
-----------
data from chunk2.p2p : Server Hello ABCD

---------
trying to get file:chunk3.p2p
Connection with server established
-----------
data from chunk3.p2p : Server Bye ABCD

---------
trying to get file:chunk4.p2p
Connection with server established
-----------
data from chunk4.p2p :

---------
Connecting with server of IP: 192.168.60.128
Connection with server established
Sent my IP
```



Screenshot captured
You can paste the image from the clipboard.

```
saif@saif:~$ cd Desktop/
saif@saif:~/Desktop$ cd Computer\ Networks/
saif@saif:~/Desktop/Computer Networks$ cd Lab\ 09
saif@saif:~/Desktop/Computer Networks/Lab 09$ ./node.out
Do you want to start client?filename :chunk0.p2p IP:192.168.60.128
filename :chunk1.p2p IP:192.168.60.128
filename :chunk2.p2p IP:192.168.60.128
filename :chunk3.p2p IP:192.168.60.128
filename :chunk4.p2p IP:192.168.60.128
Socket created successfully
Binded socket
Listening...
Called the signal: 192.168.60.128
client [0] : 192.168.60.128
client [1] :
client [2] :
client [3] :
client [4] :
Connection established with client of IP 192.168.60.128Done
====
save
====
data: CN Assignment 9

Sent file
Called the signal
Updating manifest for file: chunk0.p2p with IP: 192.168.60.128Manifest Updated
data: Random data by 202212012

Sent file
data: Server Hello ABCD

Sent file
data: Server Bye ABCD

Sent file
data:

Sent file
Called the signal: 192.168.60.128
client [0] : 192.168.60.128
client [1] : 192.168.60.128
client [2] :
client [3] :
client [4] :
Connection established with client of IP 192.168.60.128Done
```