시스템 프로그래밍 실습

6차 과제

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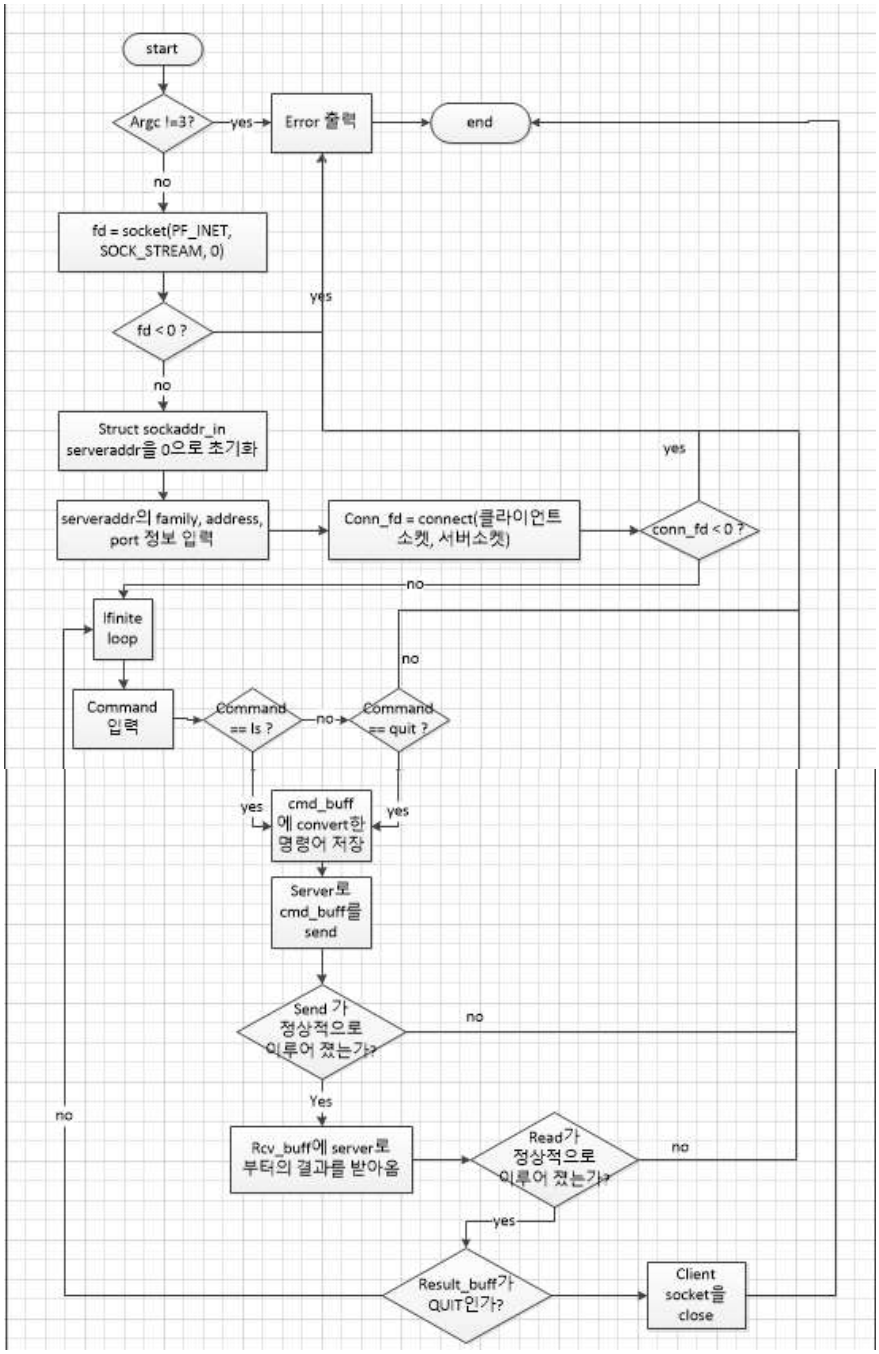
■ Introduction

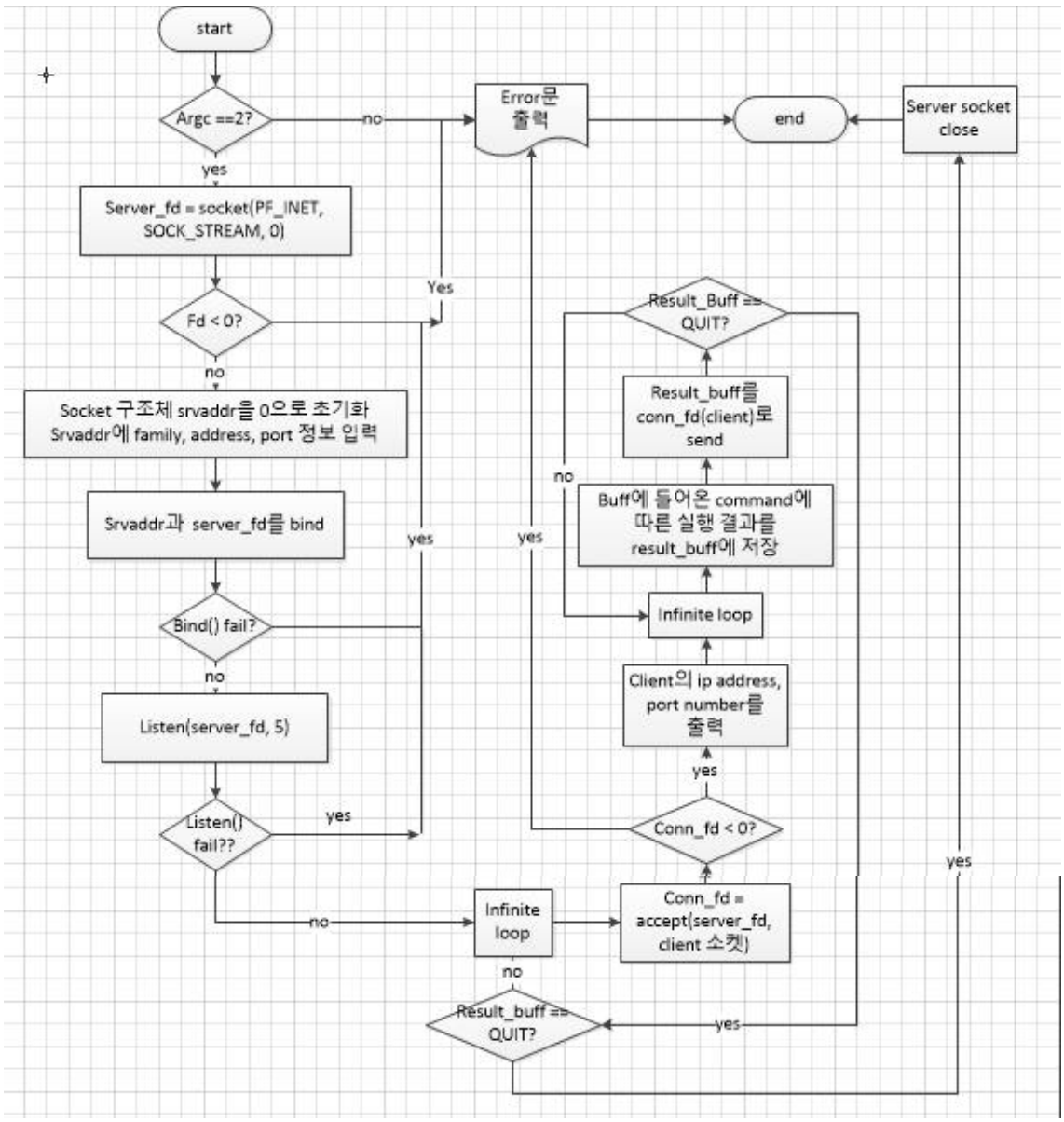
기존의 클라이언트 / 서버 통신 방식에서와 다르게 직접 소켓을 생성하고 주소와 bind하는 등 실제 네트워크 프로토콜에서 동작하는 방식을 구현해 봄으로써 ftp의 원리를 심도 있게 이해한다.

■ Flow Chart

1. client



2. server


start
Argc ==2?
no
Error문 출력
end
Server socket close
yes
Server_fd = socket(PF_INET, SOCK_STREAM, 0)
Fd < 0?
Yes
no
Socket 구조체 srvaddr을 0으로 초기화
Srvaddr에 family, address, port 정보 입력
Srvaddr과 server_fd를 bind
yes
Bind() fail?
no
Listen(server_fd, 5)
Listen() fail??
yes
no
Infinite loop
Conn_fd = accept(server_fd, client 소켓)
no
Result_buff == QUIT?
yes
yes
Result_Buff == QUIT?
Result_buff를 conn_fd(client)로 send
no
Buff에 들어온 command에 따른 실행 결과를 result_buff에 저장
Infinite loop
Client의 ip address, port number를 출력
yes
Conn_fd < 0?
yes
yes

■ Source Code

1. srv.c

```
#include <unistd.h>
#include <stdio.h>
#include <string.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <arpa/inet.h>
#include <dirent.h>
#define MAX_BUFF 500
#define SEND_BUFF 500


int client_info(struct sockaddr_in* clientaddr)
{
        char temp[200];
        char ip[20] ;
        int port;
        if(inet_ntoa(clientaddr->sin_addr) < 0) return -1;
        else strcpy(ip, inet_ntoa(clientaddr->sin_addr));
        if(ntohs(clientaddr->sin_port) < 0) return -1;
        else port = ntohs(clientaddr->sin_port);

        sprintf(temp, "========Client info========₩nIP address : %s₩n₩nPort # : %d
₩n============================₩n", ip, port);
        write(STDOUT_FILENO, temp, strlen(temp)); // print input info
        return 0;

}


int cmd_process(char* buff, char* result_buff)  // excute inserted command
{
        DIR* dp;                                        // for open directory
        struct dirent *dirp;

        if((dp = opendir(".")) < 0) // open current directory
                return -1;
        write(STDOUT_FILENO, buff, strlen(buff)); // print passed command
        write(STDOUT_FILENO, "₩n", strlen("₩n"));
        if(!strcmp(buff, "NLST")) // if input command is NLST
        {
                while(dirp = readdir(dp))
                {
                        // print files in the current directory
                        strcat(result_buff, dirp->d_name);
                        strcat(result_buff, "₩n");
                }
        }
```

```
        else if(!strcmp(buff, "QUIT")) // if input command is QUIT
        {
                strcpy(result_buff,"QUIT");
        }
        else                                                    // About other command,
return -1
                return -1;

        return 0;
}


int main(int argc, char **argv)
{
        char buff[MAX_BUFF], result_buff[SEND_BUFF]; // array for 'converted command(input)', 'result
(output)'
        int n;
        int server_fd, conn_fd;                                 //      socket
discriptor for server and client
        int clilen;                                                     /       /
client struct's size
        struct sockaddr_in srvaddr, cliaddr;            // socket address struct


        if(argc != 2)  // if wrong input case
        {
                write(STDOUT_FILENO, "Server error : Check Port Numver₩n", strlen("Server error : Check
Port Numver₩n"));
                return -1;
        }

        /* open socket */
        if((server_fd = socket(PF_INET, SOCK_STREAM,0)) < 0)
        {
                write(STDERR_FILENO, "Server : socket() err!!₩n", strlen("Server : socket() err!!₩n"));
                return -1;
        }

        /* initialize server socket struct */
        memset(&srvaddr, 0, sizeof(srvaddr));
        srvaddr.sin_family= PF_INET;
        srvaddr.sin_addr.s_addr = inet_addr("127.0.0.1");
        srvaddr.sin_port = htons(atoi(argv[1]));

        //bind socket with address
        if(bind(server_fd, (struct sockaddr*)&srvaddr, sizeof(srvaddr)) < 0)
        {
                write(STDERR_FILENO, "Server : bind() err!!₩n", strlen("Server : bind() err!!₩n"));
                return -1;//exit(1);
        }
```

```
	// listen	(5 time)
	if(listen(server_fd, 5) < 0)
	{
		write(STDERR_FILENO, "Server : listen() err!!₩n", strlen("Server : listen() err!!₩n"));
		return -1;

	}



	for(;;)
	{

		clilen = sizeof(cliaddr);
		/* accept client's connection */
		conn_fd = accept(server_fd, (struct sockaddr* ) &cliaddr, &clilen);
		if(conn_fd < 0)  // connection falied case
		{
			write(STDERR_FILENO, "Server : accept() err!!₩n", strlen("Server : accept()
err!!₩n"));
			return -1;
		}
		/*display client ip and port*/
		if(client_info(&cliaddr) < 0)
		{
			write(STDERR_FILENO,"Server : client_info() err!!₩n", strlen("Server : client_info()
err!!₩n"));
			return -1;
		}

		while(1)
		{
			n = read(conn_fd, buff, MAX_BUFF);
			buff[n] = '₩0';

			if(cmd_process(buff, result_buff) < 0)
			/*command execute and result*/
			{
				write(STDERR_FILENO, "Server : cmd_process() err!!₩n", strlen("Server :
cmd_process() err!!₩n"));
				break;
			}
			/* send result to client */
			write(conn_fd, result_buff, strlen(result_buff));

			/* if converted command is QUIT*/
			if(!strcmp(result_buff, "QUIT"))
			{
				write(STDOUT_FILENO, "Server Quit!!₩n", strlen("Server Quit!!₩n"));
```

```
                                        break;
                                }
                        }
                        if(!strcmp(result_buff, "QUIT")) // break loop
                                break;

        }
        close(server_fd); // close server socket
        return 0;
}
```

2. cli.c

```
#include <unistd.h>
#include <stdio.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <string.h>
#define MAX_BUFF 500
#define RCV_BUFF 500

int conv_cmd(char* buff, char* cmd_buff) // command converter
{
        if(!strcmp(buff, "ls")) // convert 'ls' to 'NLST'
                strcpy(cmd_buff, "NLST");
        else if(!strcmp(buff, "quit"))  // convert 'quit' to 'QUIT'
                strcpy(cmd_buff, "QUIT");
        else return -1; // About other commands, return -1

        return 0;
}

void process_result(char* rcv_buff) // print recieved result
{
        write(STDOUT_FILENO, rcv_buff, strlen(rcv_buff));
}
int main (int argc, char **argv)
{
        char buff[MAX_BUFF], cmd_buff[MAX_BUFF], rcv_buff[RCV_BUFF]; // array for 'user command',
'converted command', 'recieve result'
        int n;
        char temp[100];
        int client_fd, conn_fd;                                                 // client socket discripter /
server socket discripter
        char* IP_addr;
        char*   port_num;
        struct sockaddr_in srvaddr;                                             // server socket sturct

        if(argc != 3) // uncorrect input case
        {
        write(STDERR_FILENO, "Client : Need IP address / Port Number₩n", strlen("Client : Need IP address /
Port Number₩n"));
        return -1;
        }


        /* open socket */
        if((client_fd = socket(PF_INET, SOCK_STREAM, 0)) < 0)
        {
                write(STDERR_FILENO, "Client : socket() error!!₩n", strlen("Client : socket() error!!₩n"));
                return -1;
        }
```

```
	/* connect to server */
	port_num = argv[2];
	IP_addr = argv[1];

	// initialize srvaddr
	memset(&srvaddr, 0, sizeof(srvaddr));
	srvaddr.sin_family = PF_INET;
	srvaddr.sin_addr.s_addr = inet_addr(IP_addr);
	srvaddr.sin_port = htons(atoi(port_num));

	// if client failed to connect with server
	if((conn_fd = connect(client_fd,(struct sockaddr*)&srvaddr, sizeof(srvaddr))) < 0)
	{
		write(STDERR_FILENO, "Client : connect() error!!₩n", strlen("Client : connect() error!!₩n"));
		return -1;
	}


	for(;;)
	{
		write(STDOUT_FILENO, "CMD>> ", strlen("CMD>> "));
		read(STDIN_FILENO, buff, MAX_BUFF);
		n = strlen(buff);
		buff[n-1] = '₩0';

		if(conv_cmd(buff, cmd_buff) < 0) // convert command
		{
			write(STDERR_FILENO, "Client : conv_cmd() error!!₩n", strlen("Client : conv_cmd()
error!!₩n"));
			return -1;
		}

		n = strlen(cmd_buff); // get converted command's length

		// send converted command to server
		if(write(client_fd, cmd_buff, n) != n)
		{
			write(STDERR_FILENO, "Client : write() error!!₩n", strlen("Client : write()
error!!₩n"));
			return -1;
		}

		// read result from server
		if((n= read(client_fd, rcv_buff, RCV_BUFF-1)) < 0)
		{
			write(STDERR_FILENO, "Client : read() error!!₩n", strlen("Client : read()
error!!₩n"));
			return -1;
		}
```

```
                // add null into result array
                rcv_buff[n] = '₩0';


                if(!strcmp(rcv_buff, "QUIT")) // if recieved command was quit
                {
                        write(STDOUT_FILENO, "Program quit!!₩n", strlen("Program quit!!₩n"));
                        close(client_fd);       // close socket
                        return 0;
                }

                process_result(rcv_buff); // display ls command result
        }
        return 0;
}
```

■ Result

- 처음에 서버를 열지 않고 클라이언트에서 연결을 시도하자 에러가 뜨는 것을 확인할 수 있다.
- 서버 실행 시 포트 넘버를 주지 않으면 에러가 뜬다.
- 서버를 열고 클라이언트에서 연결을 하자 서버 측에 클라이언트의 info가 뜨는 것을 확인 할 수 있다.
- ls 명령어 입력 시, 서버 측으로 NLST 명령어가 넘어가고 이에 대한 결과가 클라이언트로 넘어와서 출력되는 것을 볼 수 있다.
- quit 명령어 입력 시, 서버 측으로 QUIT 명령어가 넘어가고 서버 소켓이 close되고 서버 종료, 이후 클라이언트 쪽 소켓도 닫고 클라이언트 종료