

Practical Work 1: TCP File Transfer

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1 Goal

The goal of this practical work is to implement a 1-1 file transfer over TCP/IP using a Command Line Interface (CLI). The system is composed of:

- one TCP server,
- one TCP client,
- communication over IPv4 sockets on localhost.

The implementation language is C, compiled and executed on Kali Linux with gcc.

2 Protocol Design

The protocol is intentionally simple. The client and server use a fixed TCP port (8080) and a fixed IP address (127.0.0.1). No application-level headers are sent:

- the client opens file example file.txt and sends its content as a byte stream;
- the server receives bytes on the socket and writes them to received file.txt;
- the end of file transfer is detected when the client closes the connection and the server's recv() returns 0.

Figure 1 describes the client-server interaction from socket creation to file transfer completion.

At a higher level, the communication can be viewed as the client connecting to the server through the network, sending the file, and closing the connection (Figure 2).

3 System Organization

The system is organized into two programs: server and client. Both run in the same directory /home/kali/Documents/Practical Work/Practical Work 1.

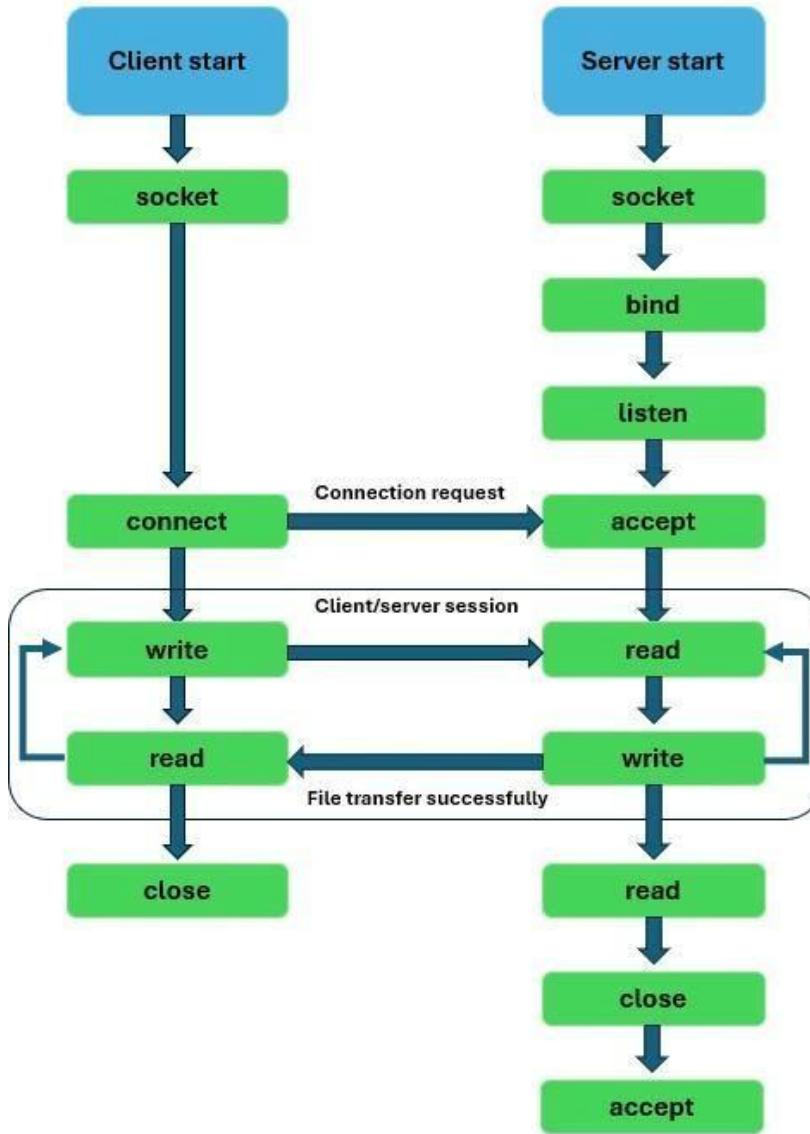


Figure 1: Client–server TCP file transfer flow (socket, connect, write/read, close).

Server

The server performs the following steps:

1. create a TCP socket (socket());
2. bind the socket to IP 127.0.0.1 and port 8080 (bind());
3. listen for incoming connections (listen());
4. accept a single connection (accept());
5. receive file data using recv() and write it to received .file.txt;

6. close the connection.

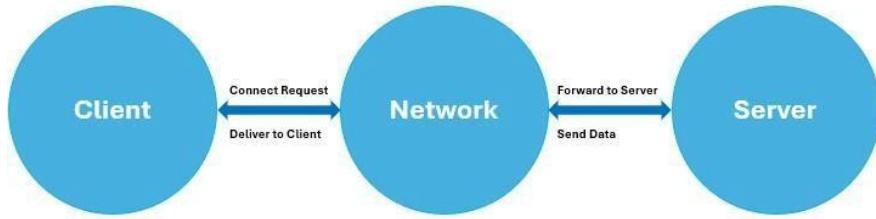


Figure 2: High-level architecture: Client–Network–Server.

Client

The client performs these steps:

1. create a TCP socket;
2. connect to 127.0.0.1:8080 (`connect()`);
3. open example file.txt in read mode;
4. send file content to the server using `send()`;
5. close the socket when finished.

4 Implementation Details

4.1 Server Code (C)

Listing 1: Server program (`server.c`).

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <arpa/inet.h>
#include <unistd.h> #define SIZE 1024

void write_file(int sockfd) { int n; FILE *fp; char *filename =
    "received_file.txt"; char buffer[SIZE];

    fp = fopen(filename, "w"); if (fp == NULL) {
        perror("Error in creating file."); exit(1);
    }
    while (1) { n = recv(sockfd, buffer, SIZE, 0);
```



```

        if (n <= 0) {
            break;
        }
        fprintf(fp, "%s", buffer); bzero(buffer, SIZE); }
fclose(fp);
}

int main() { char *ip = "127.0.0.1"; int
port = 8080; int e;

int      sockfd, new_sock;      struct sockaddr_in
server_addr, new_addr; socklen_t addr_size;

sockfd = socket(AF_INET, SOCK_STREAM, 0); if (sockfd < 0)
{ perror("Error in socket"); exit(1); }
printf("Server socket created.\n");

server_addr.sin_family = AF_INET; server_addr.sin_port = port;
server_addr.sin_addr.s_addr = inet_addr(ip); e = bind(sockfd, (struct
sockaddr *)&server_addr, sizeof(server_addr))

; if
(e < 0) {
    perror("Error in binding"); exit(1);
} printf("Binding successfully.\n");

if (listen(sockfd, 10) == 0) { printf("Listening...\n");
} else { perror("Error in listening");
    exit(1);
}

addr_size = sizeof(new_addr);
new_sock = accept(sockfd, (struct sockaddr *)&new_addr, &addr_size);

write_file(new_sock); printf("Data written in the text file.\n");

close(new_sock);
close(sockfd); return 0;
}

```

4.2 Client Code (C)

Listing 2: Client program (client.c).

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <string.h>
#include <arpa/inet.h> #define SIZE 1024 void

send_file(FILE *fp, int sockfd) { char data[SIZE] = {0};

    while (fgets(data, SIZE, fp) != NULL) { if (send(sockfd, data, sizeof(data), 0) == -1) {
        perror("Error in sending data"); exit(1);
        } bzero(data, SIZE);
    }
}

int main() { char *ip = "127.0.0.1"; int port = 8080; int
e;

int sockfd;
struct sockaddr_in server_addr; FILE *fp; char *filename =
"example_file.txt";

sockfd = socket(AF_INET, SOCK_STREAM, 0); if (sockfd < 0) { perror("Error in socket");
exit(1); } printf("Server socket created.\n"); server_addr.sin_family = AF_INET;
server_addr.sin_port = port; server_addr.sin_addr.s_addr = inet_addr(ip);

e = connect(sockfd, (struct sockaddr *)&server_addr, sizeof( server_addr)); if
(e == -1) {
    perror("Error in connecting"); exit(1);
}
```

```

printf("Connected to server.\n");

fp = fopen(filename, "r"); if (fp == NULL) {
    perror("Error in reading file."); exit(1);
}

send_file(fp, sockfd); printf("File data sent successfully.\n");
close(sockfd); printf("Disconnected from the server.\n"); return 0;
}

```

5 Execution and Testing

All experiments are run on Kali Linux. The source files are compiled with gcc and the input file is created using the shell:

```

gcc server.c -o server
gcc client.c -o client
echo "Hello from client" > example_file.txt

```

Figure 3 shows the compilation commands and the creation of example file.txt.

A terminal window showing three commands: gcc server.c -o server, gcc client.c -o client, and echo "Hello from client" > example_file.txt. The output for each command is shown below the command itself.

```

(kali㉿kali)-[~/Documents/Practical Work 1/Practical Work 1]
$ gcc server.c -o server
(kali㉿kali)-[~/Documents/Practical Work 1/Practical Work 1]
$ gcc client.c -o client
(kali㉿kali)-[~/Documents/Practical Work 1/Practical Work 1]
$ echo "Hello from client" > example_file.txt

```

Figure 3: Compiling the C programs and creating the input file.

The server is started in one terminal and the client in another (Figure 4). The log messages confirm that the connection is established and that the file is sent and written successfully.

Two terminal windows side-by-side. The left window shows the server's perspective, starting with "Server socket created.", followed by "Binding Successfull.", "Listening ...", and "Data written in the text file". The right window shows the client's perspective, starting with "Server socket created.", "Connected to server.", "File data send successfully.", and "Disconnected from the server.".

Figure 4: Server and client running in two terminals on Kali Linux.

The working directory after execution contains the compiled binaries and both text files (example file.txt and received file.txt), as shown in Figure 5.

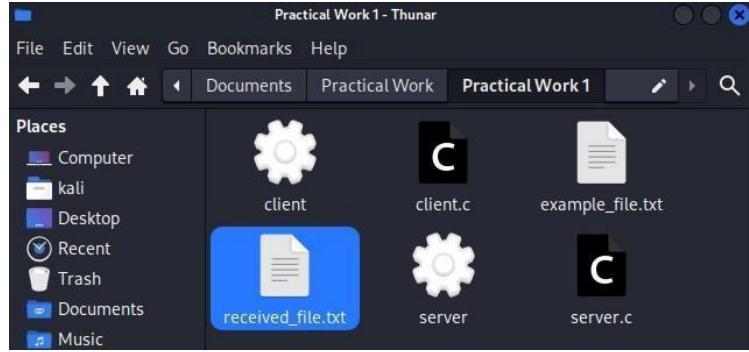


Figure 5: Files in the project directory after a successful transfer.

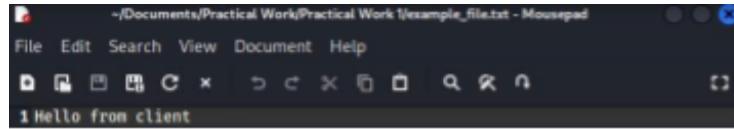


Figure 6: Content of example_file.txt (clientside).

Figure 6 shows the content of example file.txt on the client side.

Finally, Figure 7 shows the network configuration (`ip r`) confirming that both processes run on the same host.

```
(kali㉿kali)-[~/Documents/Practical Work/Practical Work 1]
└─$ ./server
Server socket created.
Binding Successfull.
Listening...
Data written in the text file

(kali㉿kali)-[~/Documents/Practical Work/Practical Work 1]
└─$ ip r
default via 192.168.79.2 dev eth0 proto dhcp src 192.168.79.134 metric 100
192.168.79.0/24 dev eth0 proto kernel scope link src 192.168.79.134 metric 100
0

(kali㉿kali)-[~/Documents/Practical Work/Practical Work 1]
└─$ ./client
Server socket created.
Connected to server.
File data send successfully.
Disconnected from the server.

(kali㉿kali)-[~/Documents/Practical Work/Practical Work 1]
└─$ ip r
default via 192.168.79.2 dev eth0 proto dhcp src 192.168.79.134 metric 100
192.168.79.0/24 dev eth0 proto kernel scope link src 192.168.79.134 metric 100
0
```

Figure 7: IP routing table on Kali Linux used during testing.

6 Conclusion

In this practical work, a minimal but functional TCP file transfer system was implemented in C on Kali Linux. The client and server programs use the standard BSD socket API to establish a connection over 127.0.0.1:8080 and transfer a text file from client to server.

The tests show that the design and implementation correctly achieve the goal of one to-one file transfer over TCP/IP. Possible extensions include adding support for variable filenames, binary files, error codes, and multi-client handling.