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Wipro COE Embedded System

PROJECT REPORT

ON

“Network File Sharing Server & Client”

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Secure File Transfer System using  
Socket Programming in C++

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## Abstract

This project demonstrates a Secure File Transfer System developed using C++ and socket programming. The system establishes a secure connection between a client and a server, allowing encrypted file transfers, authentication, and file management operations. It is implemented for both Windows and Linux platforms, ensuring cross-platform compatibility and robust network performance.

## Objective

The objective of this project is to design and develop a secure and efficient communication framework for transferring files between a client and server using socket programming. The system ensures authentication, encrypted data exchange, and platform independence.

## System Architecture

The project uses a client-server model where the server listens for connections on a specified port and the client initiates communication. The communication process includes:

1. Establishing a TCP connection.
2. Authenticating the user.
3. Executing file operations (LIST, GET, PUT, QUIT).
4. Encrypting data using an XOR cipher.
5. Handling file I/O with multithreading for concurrent clients.

## Windows Implementation

The following code snippet represents the Windows implementation of the server:

```
Windows Server Code: #ifndef _WIN32_WINNT #define _WIN32_WINNT 0x0A00

#endif #define WIN32_LEAN_AND_MEAN
#include <windows.h>

#include <winsock2.h>

#include <ws2tcpip.h>

#pragma comment(lib, "ws2_32.lib")

#include <iostream>

#include <string>
```

```
#include <cstring>
#include <cstdint>
#include <thread>
#include <vector>
#include <fstream>
#include <sstream>
#include <map>
#include <filesystem>
#include <sys/types.h>
#include <sys/stat.h>
```

```
#define PORT 8080 #define
BUFFER_SIZE 4096
```

```
const std::string XOR_KEY = "mysecretkey";
```

```
std::string xor_cipher(const std::string &data) {
    std::string output = data; for (std::size_t i = 0;
    i < output.length(); ++i) output[i] ^=
    XOR_KEY[i % XOR_KEY.length()]; return
    output;
}
```

```
std::map<std::string, std::string> users = {
    {"admin", "pass123"},
    {"Anirban", "getbetter17"}
};
```

```

bool authenticate_user(const std::string &auth_string) { std::stringstream
    ss(auth_string); std::string cmd, user, pass; ss >> cmd >> user >> pass;
    return (cmd == "AUTH" && users.count(user) && users[user] == pass);
}

```

```

long long get_file_size(const std::string &filename) {
    struct __stat64 stat_buf; int rc =
        _stat64(filename.c_str(), &stat_buf); return rc ==
        0 ? stat_buf.st_size : -1;
}

```

```

void receive_file(SOCKET sock, const std::string &filename, long long file_size) {
    char buffer[BUFFER_SIZE] = {0}; std::filesystem::create_directory("server_files");
    std::ofstream output_file("server_files/" + filename, std::ios::binary);
    if(!output_file) { std::string msg = xor_cipher("ERROR: Cannot create
        file."); send(sock, msg.c_str(), (int)msg.length(), 0); return; }

```

```

    std::string ready = xor_cipher("READY");
    send(sock, ready.c_str(), (int)ready.length(), 0);

```

```

    long long bytes_received = 0; while(bytes_received < file_size) { int bytes_to_read =
        (int)std::min<long long>(BUFFER_SIZE, file_size - bytes_received); int bytes_read =
        recv(sock, buffer, bytes_to_read, 0); if(bytes_read <= 0) break;

```

```

        output_file.write(buffer, bytes_read); bytes_received
            += bytes_read;

```

```
}
```

```
output_file.close();
```

```
std::string response = xor_cipher(bytes_received == file_size
```

```
?"OK: Upload successful."
```

```
:"ERROR: Upload failed."); send(sock,
```

```
response.c_str(), (int)response.length(), 0); }
```

```
void handle_client(SOCKET client_socket) {
```

```
    char buffer[BUFFER_SIZE] = {0};
```

```
    bool authenticated = false;
```

```
    std::cout << "[+] Client connected. Awaiting authentication..." << std::endl;
```

```
    while(true) { memset(buffer, 0, BUFFER_SIZE); int bytes_read =
```

```
        recv(client_socket, buffer, BUFFER_SIZE - 1, 0); if(bytes_read
```

```
        <= 0) { std::cout << "[-] Client disconnected." << std::endl;
```

```
        break; }
```

```
    std::string command = xor_cipher(std::string(buffer, bytes_read)); std::cout
```

```
    << "[Client] " << command << std::endl;
```

```
    if(!authenticated) { std::string msg;
```

```
    if(authenticate_user(command)) { authenticated = true; msg
```

```
    = xor_cipher("OK: Auth successful. Welcome!"); std::cout <<
```

```
    "[+] Authentication successful." << std::endl;
```

```
    }else {
```

```

        msg = xor_cipher("ERROR: Auth failed. Invalid user/pass.");
        std::cout << "[-] Authentication failed." << std::endl;
        send(client_socket, msg.c_str(), (int)msg.length(), 0); break;
    } send(client_socket, msg.c_str(), (int)msg.length(),
0); continue; }

if(command == "LIST") { std::filesystem::create_directory("server_files");
    std::string list = "Files on server:\n"; for(auto &entry :
    std::filesystem::directory_iterator("server_files")) list +=
    entry.path().filename().string() + "\n"; std::string encrypted_list =
    xor_cipher(list); send(client_socket, encrypted_list.c_str(),
    (int)encrypted_list.length(), 0);
}

elseif(command.rfind("GET ", 0) == 0) { std::string
    filename = command.substr(4); std::string
    filepath = "server_files/" + filename;

    if(filename.find(".") != std::string::npos) { std::string msg =
        xor_cipher("ERROR: Invalid filename.");
        send(client_socket, msg.c_str(), (int)msg.length(), 0);
        continue;
    }

    longlong file_size = get_file_size(filepath); if(file_size < 0)
    { std::string msg = xor_cipher("ERROR: File not found.");
    send(client_socket, msg.c_str(), (int)msg.length(), 0);
    continue; }

```

```

std::string msg = xor_cipher("SIZE " + std::to_string(file_size));
send(client_socket, msg.c_str(), (int)msg.length(), 0);

memset(buffer, 0, BUFFER_SIZE);

recv(client_socket, buffer, BUFFER_SIZE - 1, 0);

if(xor_cipher(std::string(buffer)) != "READY")
    continue;

std::ifstream file(filepath, std::ios::binary);
while(file) { file.read(buffer, BUFFER_SIZE);
std::streamsize bytes = file.gcount(); if(bytes
> 0) send(client_socket, buffer, (int)bytes,
0);
}
file.close();
}
elseif (command.rfind("PUT ", 0) == 0) {
    std::stringstream ss(command);
    std::string cmd, filename; long long
    file_size; ss>> cmd >> filename >>
    file_size;

    if(filename.empty() || file_size <= 0) { std::string msg =
    xor_cipher("ERROR: Bad PUT command."); send(client_socket,
    msg.c_str(), (int)msg.length(), 0); continue; }

    if(filename.find(".") != std::string::npos) { std::string msg =
    xor_cipher("ERROR: Invalid filename."); send(client_socket,
    msg.c_str(), (int)msg.length(), 0); continue; }

```

```

        receive_file(client_socket, filename, file_size);
    }

    elseif (command == "QUIT") { std::cout << "[x] Client
        exited session." << std::endl; break;
    }
    else {

        std::string msg = xor_cipher("Unknown command."); send(client_socket,
            msg.c_str(), (int)msg.length(), 0);
    }
}

closesocket(client_socket);
}

int main() {
    WSADATA wsaData; if(WSAStartup(MAKEWORD(2,
    2), &wsaData) != 0) { std::cerr << "WSAStartup
    failed." << std::endl; return 1;
    }

    SOCKET server_fd = socket(AF_INET, SOCK_STREAM, IPPROTO_TCP);
    if(server_fd == INVALID_SOCKET) { std::cerr << "Socket creation failed: "
    << WSAGetLastError() << std::endl; WSACleanup();
        return 1; }

    sockaddr_in address{};
    address.sin_family = AF_INET;

```



```
address.sin_addr.s_addr = INADDR_ANY;
```

```
address.sin_port = htons(PORT);
```

```
if(bind(server_fd, (sockaddr *)&address, sizeof(address)) == SOCKET_ERROR) {
```

```
    std::cerr << "Bind failed: " << WSAGetLastError() << std::endl;
```

```
    closesocket(server_fd); WSACleanup();
```

```
    return 1;
```

```
}
```

```
if(listen(server_fd, 5) == SOCKET_ERROR) { std::cerr << "Listen
```

```
failed: " << WSAGetLastError() << std::endl;
```

```
closesocket(server_fd); WSACleanup();
```

```
return 1;
```

```
}
```

```
std::cout << "[SERVER] Secure server listening on port " << PORT << "..." << std::endl;
```

```
while(true) { sockaddr_in client_addr{};
```

```
    int client_addr_len = sizeof(client_addr);
```

```
    SOCKET new_socket = accept(server_fd, (sockaddr *)&client_addr, &client_addr_len);
```

```
    if(new_socket == INVALID_SOCKET) { std::cerr << "Accept failed: "
```

```
        << WSAGetLastError() << std::endl; continue;
```

```
}
```

```
    std::thread(handle_client, new_socket).detach();
```

```
}
```

```
    closesocket(server_fd);  
    WSACleanup();  
    return 0;  
}
```

Refer to your provided server.cpp for complete implementation.

The following code snippet represents the Windows implementation of the client:

Windows Client Code:

---

```
#include <iostream>  
  
#include <string>  
  
#include <cstring>  
  
#include <fstream>  
  
#include <sstream>  
  
  
#include <winsock2.h>  
  
#include <ws2tcpip.h>  
  
#include <sys/types.h>  
  
#include <sys/stat.h>  
  
#define PORT 8080  
#define BUFFER_SIZE 4096  
  
  
//code  
  
const std::string XOR_KEY = "mysecretkey";
```

```

std::string xor_cipher(std::string data) { std::string output =
    data; for(int i = 0; i < output.length(); ++i) { output[i] =
    output[i] ^ XOR_KEY[i % XOR_KEY.length()];
    } return
    output;
}

```

```

longlong get_file_size(const std::string &filename) { std::ifstream
    in(filename, std::ifstream::ate | std::ifstream::binary); if (!in) return
    -1; return (long long)in.tellg();
}

```

```

void send_file(SOCKET sock, std::string filename, long long file_size) { char
    buffer[BUFFER_SIZE] = {0};

    memset(buffer, 0, BUFFER_SIZE); int bytes_read =
    recv(sock, buffer, BUFFER_SIZE - 1, 0); if (bytes_read
    <= 0) {
        std::cerr << "Error: Server disconnected while waiting for READY." << std::endl; return;
    } std::string server_response = xor_cipher(std::string(buffer,
    bytes_read));

    if(server_response != "READY") {
        std::cerr << "Error: Server not ready: " << server_response << ". Aborting upload." <<
        std::endl;
        return; }
}

```

```

std::ifstream file_to_send(filename, std::ios::binary); if(!file_to_send) { std::cerr
<< "Error: Could not open file for reading: " << filename << std::endl; return; }

longlong bytes_sent = 0; while(file_to_send) { file_to_send.read(buffer,
BUFFER_SIZE); std::streamsize bytes_actually_read = file_to_send.gcount();
if(bytes_actually_read > 0) { intsent = send(sock, buffer,
(int)bytes_actually_read, 0); if(sent == SOCKET_ERROR) { std::cerr << "Error
sending data: " << WSAGetLastError() << std::endl; file_to_send.close();

        return; }

        bytes_sent += sent;

    } }
file_to_send.close();

memset(buffer, 0, BUFFER_SIZE); bytes_read = recv(sock, buffer, BUFFER_SIZE - 1, 0);
if(bytes_read <= 0) { std::cerr << "Error: Server disconnected while waiting for final
response." << std::endl; return; }

std::cout << "Server response: " << xor_cipher(std::string(buffer, bytes_read)) <<
std::endl; }

voidreceive_file(SOCKET sock, std::string filename, long long file_size) { char
buffer[BUFFER_SIZE] = {0};

std::string encrypted_ready = xor_cipher("READY"); send(sock,
encrypted_ready.c_str(), (int)encrypted_ready.length(), 0);

std::ofstream output_file(filename, std::ios::binary); if(!output_file) {
std::cerr << "Error: Could not create file " << filename << std::endl;
return; }

```

```

longlong bytes_received = 0; while(bytes_received <
file_size) { intbytes_to_read = BUFFER_SIZE;
if(file_size - bytes_received < BUFFER_SIZE) {
bytes_to_read = (int)(file_size - bytes_received);
}

    intbytes_read = recv(sock, buffer, bytes_to_read, 0); if(bytes_read ==
SOCKET_ERROR) { std::cerr << "Error receiving data: " <<
WSAGetLastError() << std::endl; break; } if(bytes_read == 0) {
    std::cerr << "Error: Server disconnected during file transfer unexpectedly." <<
std::endl;
    break; }

    output_file.write(buffer, bytes_read); bytes_received
    += bytes_read;
}
output_file.close();
if (bytes_received
== file_size) {
std::cout <<
"Download
complete: " <<
filename <<
std::endl;
} else {
    std::cout << "Download failed. Received " << bytes_received << " of " << file_size << "
bytes." << std::endl;
} }

```

```

boolInitializeWinsock() { WSADATA wsaData;

    if(WSAStartup(MAKEWORD(2, 2), &wsaData) != 0) {

        std::cerr << "WSAStartup failed.\n"; return false;

    } return

        true;

}

```

```

voidCleanupWinsock() {

    WSACleanup();

}

```

```

intmain() {

    if(!InitializeWinsock()) { return

        1;

    }

    SOCKET sock = INVALID_SOCKET;

    struct sockaddr_in serv_addr;

    char buffer[BUFFER_SIZE] = {0};

    if((sock = socket(AF_INET, SOCK_STREAM, IPPROTO_TCP)) == INVALID_SOCKET) {

        std::cerr << "\n Socket creation error: " << WSAGetLastError() << std::endl;

        CleanupWinsock();

        return -1;

    }

```

```

    memset(&serv_addr, 0, sizeof(serv_addr));

    serv_addr.sin_family = AF_INET; serv_addr.sin_port

    = htons(PORT);

```

```

unsigned long ip_address = inet_addr("127.0.0.1");

if(ip_address == INADDR_NONE) { std::cerr << "\nInvalid
address/ Address not supported \n"; closesocket(sock);
CleanupWinsock();

    return -1;
} serv_addr.sin_addr.s_addr =
ip_address;

if(connect(sock, (struct sockaddr *)&serv_addr, sizeof(serv_addr)) == SOCKET_ERROR) {
    std::cerr << "\nConnection Failed: " << WSAGetLastError() << std::endl;
    closesocket(sock);
    CleanupWinsock();
    return -1;
}

std::string user, pass, auth_string; std::cout << "Connected to secure
server. Please log in." << std::endl; std::cout << "Username: ";
std::getline(std::cin, user); std::cout << "Password: ";
std::getline(std::cin, pass);

auth_string = "AUTH " + user + " " + pass;

std::string encrypted_auth = xor_cipher(auth_string); send(sock,
encrypted_auth.c_str(), (int)encrypted_auth.length(), 0);

memset(buffer, 0, BUFFER_SIZE); int bytes_read =
recv(sock, buffer, BUFFER_SIZE - 1, 0); if(bytes_read
== SOCKET_ERROR || bytes_read == 0) {

```

```

std::cerr << (bytes_read == SOCKET_ERROR ? "Auth response error: " +
std::to_string(WSAGetLastError()) : "Server disconnected during authentication.") <<
std::endl; closesocket(sock); CleanupWinsock(); return -1;
}
std::string auth_response = xor_cipher(std::string(buffer, bytes_read));

if(auth_response.rfind("ERROR:", 0) == 0) {
std::cerr << auth_response << std::endl;
closesocket(sock); CleanupWinsock();
return -1; }

std::cout << auth_response << std::endl;

std::cout << "Type 'LIST', 'GET <file>', 'PUT <file>', or 'QUIT'." << std::endl;

while(true) { std::string
    user_input; std::cout << "> ";
    std::getline(std::cin, user_input);

    if(user_input.empty()) continue;

    if(user_input.rfind("PUT ", 0) == 0) { std::string filename =
        user_input.substr(4); long long file_size = get_file_size(filename);
        if(file_size < 0) { std::cout << "Error: File not found or cannot be read."
        << std::endl; continue;

    }

```



```

std::string command_to_send = "PUT " + filename + " " + std::to_string(file_size);
std::string encrypted_command = xor_cipher(command_to_send); send(sock,
encrypted_command.c_str(), (int)encrypted_command.length(), 0);

std::cout << "Uploading " << filename << " (" << file_size << " bytes)..." << std::endl;
send_file(sock, filename, file_size);
} else{ std::string encrypted_input = xor_cipher(user_input); send(sock,
encrypted_input.c_str(), (int)encrypted_input.length(), 0);

if(user_input == "QUIT") {
break; }

if(user_input.rfind("GET ", 0) == 0) { std::string
filename = user_input.substr(4);

memset(buffer, 0, BUFFER_SIZE); bytes_read =
recv(sock, buffer, BUFFER_SIZE - 1, 0);

if(bytes_read == SOCKET_ERROR || bytes_read == 0) { std::cout << "Server
disconnected or error during GET response." << std::endl; break;
}

std::string server_response = xor_cipher(std::string(buffer, bytes_read));

if(server_response.rfind("SIZE ", 0) == 0) { long long
file_size = std::stoll(server_response.substr(5));
std::cout << "Receiving " << filename << " (" << file_size << " bytes)..." <<
std::endl;

```

```

        receive_file(sock, filename, file_size);

    }else { std::cout << "Server response: " << server_response <<
        std::endl;

    } } else{ memset(buffer, 0, BUFFER_SIZE);

bytes_read = recv(sock, buffer, BUFFER_SIZE - 1, 0);

    if(bytes_read <= 0) { std::cout << "Server
        disconnected." << std::endl; break; }

        std::cout << "Server response:\n" << xor_cipher(std::string(buffer, bytes_read)) <<
std::endl;

    }

    }

}
closesocket(sock);

CleanupWinsock();

return 0;

}

```

Refer to your provided client.cpp for complete implementation.

## Linux Implementation

Below is the Linux-compatible version of the server program:

Linux Client Code:

```

// --- client/client.cpp (Phase 5 FIXED) ---

#include <iostream>

#include <string>

#include <cstring>

#include <unistd.h>

#include <sys/socket.h>

```

```
#include <arpa/inet.h>
```

```
#include <netinet/in.h>
```

```
#include <fstream>
```

```
#include <sys/stat.h>
```

```
#include <sstream>
```

```
#define PORT 8080
```

```
#define BUFFER_SIZE 4096
```

```
// --- Encryption --const std::string
```

```
XOR_KEY = "mysecretkey"; std::string
```

```
xor_cipher(std::string data) { std::string
```

```
output = data; for(int i = 0; i <
```

```
output.length(); ++i) { output[i] = output[i]
```

```
^ XOR_KEY[i % XOR_KEY.length()];
```

```
    } return
```

```
    output;
```

```
}
```

```
longget_file_size(std::string filename) {
```

```
    struct stat stat_buf; int rc =
```

```
    stat(filename.c_str(), &stat_buf); return
```

```
    rc == 0 ? stat_buf.st_size : -1;
```

```
}
```

```
voidsend_file(int sock, std::string filename, long file_size) { char
```

```
    buffer[BUFFER_SIZE] = {0};
```

```

memset(buffer, 0, BUFFER_SIZE); int bytes_read = recv(sock, buffer,
BUFFER_SIZE - 1, 0); std::string server_response =
xor_cipher(std::string(buffer, bytes_read));

if(server_response != "READY") { std::cerr << "Error: Server not ready.
    Aborting upload." << std::endl; return;
}
std::ifstream file_to_send(filename, std::ios::binary); while
(file_to_send) { file_to_send.read(buffer, BUFFER_SIZE);
std::streamsize bytes_actually_read = file_to_send.gcount();
if(bytes_actually_read > 0) { send(sock, buffer,
bytes_actually_read, 0);
    } }
file_to_send.close();

memset(buffer, 0, BUFFER_SIZE); bytes_read =
recv(sock, buffer, BUFFER_SIZE - 1, 0);

std::cout << "Server response: " << xor_cipher(std::string(buffer, bytes_read)) <<
std::endl; }

void receive_file(int sock, std::string filename, long file_size) { char
buffer[BUFFER_SIZE] = {0};

std::string encrypted_ready = xor_cipher("READY"); send(sock,
encrypted_ready.c_str(), encrypted_ready.length(), 0);

```

```

std::ofstream output_file(filename, std::ios::binary); if(!output_file) {
std::cerr << "Error: Could not create file " << filename << std::endl;
return; }

long bytes_received = 0; while(bytes_received <
file_size) { int bytes_to_read = BUFFER_SIZE;
if(file_size - bytes_received < BUFFER_SIZE) {
bytes_to_read = file_size - bytes_received;
}

int bytes_read = recv(sock, buffer, bytes_to_read, 0); if(bytes_read <= 0) {
std::cerr << "Error: Server disconnected during file transfer." << std::endl;
break; } output_file.write(buffer, bytes_read); bytes_received += bytes_read;
}
output_file.close();

if(bytes_received == file_size) { std::cout << "Download
complete: " << filename << std::endl;
} else { std::cout << "Download failed." <<
std::endl;
}
}
int main() { int sock = 0; struct
sockaddr_in serv_addr; char
buffer[BUFFER_SIZE] = {0};

```

```
if((sock = socket(AF_INET, SOCK_STREAM, 0)) < 0) {  
    std::cerr << "\n Socket creation error \n"; return -1;  
}
```

```
memset(&serv_addr, '0', sizeof(serv_addr));  
  
serv_addr.sin_family = AF_INET; serv_addr.sin_port  
= htons(PORT);
```

```
if(inet_pton(AF_INET, "127.0.0.1", &serv_addr.sin_addr) <= 0) {  
    std::cerr << "\nInvalid address/ Address not supported \n";  
    return -1; }
```

```
if(connect(sock, (struct sockaddr *)&serv_addr, sizeof(serv_addr)) < 0) {  
    std::cerr << "\nConnection Failed \n"; return -1;  
}
```

```
//--- Login Prompt ---  
std::string user, pass, auth_string; std::cout << "Connected to secure  
server. Please log in." << std::endl; std::cout << "Username: ";  
std::getline(std::cin, user); std::cout << "Password: ";  
std::getline(std::cin, pass);
```

```
auth_string = "AUTH " + user + " " + pass;
```

```
std::string encrypted_auth = xor_cipher(auth_string);  
send(sock, encrypted_auth.c_str(), encrypted_auth.length(), 0);
```

```
memset(buffer, 0, BUFFER_SIZE); intbytes_read = recv(sock, buffer,  
BUFFER_SIZE - 1, 0); std::string auth_response =  
xor_cipher(std::string(buffer, bytes_read));
```

```
if(auth_response.rfind("ERROR:", 0) == 0) {  
std::cerr << auth_response << std::endl;  
close(sock); return -1; }
```

```
std::cout << auth_response << std::endl;
```

```
std::cout << "Type 'LIST', 'GET <file>', 'PUT <file>', or 'QUIT'." << std::endl; while(true) {  
std::string user_input; std::cout << "> "; std::getline(std::cin, user_input);
```

```
if(user_input.empty()) continue;
```

```
if(user_input.rfind("PUT ", 0) == 0) { std::string filename =  
user_input.substr(4); long file_size = get_file_size(filename);  
if(file_size < 0) { std::cout << "Error: File not found or cannot be  
read." << std::endl; continue;  
}
```

```
std::string command_to_send = "PUT " + filename + " " + std::to_string(file_size);  
std::string encrypted_command = xor_cipher(command_to_send); send(sock,  
encrypted_command.c_str(), encrypted_command.length(), 0);
```

```
std::cout << "Uploading " << filename << " (" << file_size << " bytes)..." << std::endl;  
send_file(sock, filename, file_size);
```

```

    } else{ std::string encrypted_input = xor_cipher(user_input);

    send(sock, encrypted_input.c_str(), encrypted_input.length(), 0);

    if(user_input == "QUIT") { break; }

    if(user_input.rfind("GET ", 0) == 0) { std::string
        filename = user_input.substr(4);

        memset(buffer, 0, BUFFER_SIZE); bytes_read =
        recv(sock, buffer, BUFFER_SIZE - 1, 0);

        std::string server_response = xor_cipher(std::string(buffer, bytes_read));

        if(server_response.rfind("SIZE ", 0) == 0) { long
            file_size = std::stol(server_response.substr(5));

            std::cout << "Receiving " << filename << " (" << file_size << " bytes)..." <<
std::endl;

            receive_file(sock, filename, file_size);

        }else { std::cout << "Server response: " << server_response <<
            std::endl;

        } } else{ memset(buffer, 0, BUFFER_SIZE);

        bytes_read = recv(sock, buffer, BUFFER_SIZE - 1, 0);

        if (bytes_read <= 0) {

            std::cout << "Server disconnected." << std::endl;

            break; }

        std::cout << "Server response:\n" << xor_cipher(std::string(buffer, bytes_read)) <<
std::endl;

    }

```



```

    }

}

    close(sock);

    return 0;

}

```

Refer to the generated `server_linux.cpp` for the complete source code.

The client code for Linux can be adapted similarly, replacing Winsock APIs with POSIX socket calls.

Linux Server Code:

---

```
// --- server/server.cpp (Phase 5 FIXED) ---
```

```
#include <iostream>
```

```
#include <string>
```

```
#include <cstring>
```

```
#include <unistd.h>
```

```
#include <sys/socket.h>
```

```
#include <netinet/in.h>
```

```
#include <thread>
```

```
#include <vector>
```

```
#include <dirent.h>
```

```
#include <fstream>
```

```
#include <sys/stat.h>
```

```
#include <sstream>
```

```
#include <map>
```

```
#define PORT 8080
```

```
#define BUFFER_SIZE 4096
```

```
// --- Encryption --const std::string
```

```
XOR_KEY = "mysecretkey";
```

```
std::string xor_cipher(std::string data) { std::string output =  
    data; for (int i = 0; i < output.length(); ++i) { output[i] =  
        output[i] ^ XOR_KEY[i % XOR_KEY.length()];  
    } return  
    output;  
}
```

```
//--- User Authentication --std::map<std::string,  
std::string> users = {  
    {"admin", "password"},  
    {"Anirban", "getbetter17"}  
};
```

```
bool authenticate_user(std::string auth_string) { std::stringstream ss(auth_string);  
std::string cmd, user, pass; ss>> cmd >> user >> pass;
```

```
    if(cmd == "AUTH" && users.count(user) && users[user] == pass) { return  
        true;  
    } return  
    false;  
}
```

```
longget_file_size(std::string filename) {  
    struct stat stat_buf; int rc =
```

```

stat(filename.c_str(), &stat_buf); return
rc == 0 ? stat_buf.st_size : -1;
}

```

```

void receive_file(int sock, std::string filename, long file_size) { char
buffer[BUFFER_SIZE] = {0};

```

```

std::ofstream output_file("./server_files/" + filename, std::ios::binary);
if(!output_file) { std::string msg = "ERROR: Cannot create file.";
std::string encrypted_msg = xor_cipher(msg); send(sock,
encrypted_msg.c_str(), encrypted_msg.length(), 0); return;
}
std::string encrypted_ready = xor_cipher("READY"); send(sock,
encrypted_ready.c_str(), encrypted_ready.length(), 0);

```

```

long bytes_received = 0; while(bytes_received <
file_size) { int bytes_to_read = BUFFER_SIZE;
if(file_size - bytes_received < BUFFER_SIZE) {
bytes_to_read = file_size - bytes_received;
}

```

```

int bytes_read = recv(sock, buffer, bytes_to_read, 0);
if(bytes_read <= 0) { break; }
output_file.write(buffer, bytes_read);
bytes_received += bytes_read;
}
output_file.close();

```

```

std::string response_msg; if(bytes_received
== file_size) { response_msg = "OK: Upload
successful.";
} else { response_msg = "ERROR: Upload
failed.";
}
std::string encrypted_response = xor_cipher(response_msg); send(sock,
encrypted_response.c_str(), encrypted_response.length(), 0);
}

void handle_client(int client_socket) {
    char buffer[BUFFER_SIZE] = {0};
    bool authenticated = false;

    std::cout << "Client connected. Waiting for authentication..." << std::endl;

    while(true) { memset(buffer, 0, BUFFER_SIZE); int bytes_read =
        recv(client_socket, buffer, BUFFER_SIZE - 1, 0); if(bytes_read
        <= 0) { std::cout << "Client disconnected." << std::endl; break; }

        std::string raw_data(buffer, bytes_read); std::string command =
        xor_cipher(raw_data); std::cout << "Client says (decrypted): " <<
        command << std::endl;

        if(!authenticated) { std::string
            msg;
            if(authenticate_user(command)) {
                authenticated = true;

```

```

std::cout<< "Authentication successful." << std::endl; msg="OK:
Auth successful. Welcome!";

} else{ std::cout<< "Authentication failed." << std::endl; msg="ERROR:
Auth failed. Invalid user/pass."; std::string encrypted_msg =
xor_cipher(msg); send(client_socket, encrypted_msg.c_str(),
encrypted_msg.length(), 0); break;

} std::string encrypted_msg = xor_cipher(msg); send(client_socket,
encrypted_msg.c_str(), encrypted_msg.length(), 0); continue; }

if(command== "LIST") { std::string file_list = "Files on server:\n"; DIR *dir;
struct dirent *ent; if((dir=opendir("./server_files")) != NULL) {
while((ent = readdir(dir)) != NULL) { if(strcmp(ent->d_name, ".") != 0 &&
strcmp(ent->d_name, "..") != 0) { file_list += ent->d_name; file_list +=
"\n";
    } }
closedir(dir);
}else {
file_list =
"Error:
Cannot open
server_files
directory.";
} std::string encrypted_list = xor_cipher(file_list); send(client_socket,
encrypted_list.c_str(), encrypted_list.length(), 0);

}else if (command.rfind("GET ", 0) == 0) { std::string
filename = command.substr(4); std::string

```

```

filepath = "./server_files/" + filename; std::string
msg;

if(filename.find(".") != std::string::npos) { msg = "ERROR: Invalid
filename."; std::string encrypted_msg = xor_cipher(msg);
send(client_socket, encrypted_msg.c_str(), encrypted_msg.length(), 0);
continue; }

long file_size = get_file_size(filepath);

if(file_size < 0) { msg = "ERROR: File not found."; std::string
    encrypted_msg = xor_cipher(msg); send(client_socket,
    encrypted_msg.c_str(), encrypted_msg.length(), 0);
}else { msg = "SIZE " +
    std::to_string(file_size); std::string
    encrypted_msg = xor_cipher(msg);
    send(client_socket,
    encrypted_msg.c_str(),
    encrypted_msg.length(), 0);

    memset(buffer, 0, BUFFER_SIZE);
    recv(client_socket, buffer, BUFFER_SIZE - 1, 0);
    if(xor_cipher(std::string(buffer)) != "READY") {
        continue; }

    std::ifstream file_to_send(filepath, std::ios::binary); while
    (file_to_send) { file_to_send.read(buffer, BUFFER_SIZE);
    std::streamsize bytes_actually_read = file_to_send.gcount();

```

```

        if(bytes_actually_read > 0) { send(client_socket, buffer,
        bytes_actually_read, 0);

        }}

        file_to_send.close();

    } } elseif(command.rfind("PUT ", 0)
== 0) { std::stringstream ss(command);

std::string cmd, filename; longfile_size;

ss>>cmd >> filename >> file_size;

std::string msg;

    if(filename.empty() || file_size <= 0) { msg = "ERROR: Bad PUT
    command."; std::string encrypted_msg = xor_cipher(msg);

    send(client_socket, encrypted_msg.c_str(), encrypted_msg.length(), 0);

    continue; } if(filename.find(".") != std::string::npos) { msg = "ERROR:
    Invalid filename."; std::string encrypted_msg = xor_cipher(msg);

    send(client_socket, encrypted_msg.c_str(), encrypted_msg.length(), 0);

    continue; }

    receive_file(client_socket, filename, file_size);

} elseif (command == "QUIT")

{ break;

}else {

    std::string msg = "Unknown command."; std::string encrypted_msg =

    xor_cipher(msg); send(client_socket, encrypted_msg.c_str(),

    encrypted_msg.length(), 0);

    }}

close(client_socket);

}

```

```
//---Main Server Loop (No changes) --
```

```
intmain() { intserver_fd; struct
```

```
sockaddr_in address; intopt = 1;
```

```
if((server_fd = socket(AF_INET, SOCK_STREAM, 0)) == 0) {
```

```
    perror("socket failed"); exit(EXIT_FAILURE);
```

```
}
```

```
if(setsockopt(server_fd, SOL_SOCKET, SO_REUSEADDR, &opt, sizeof(opt))) {
```

```
    perror("setsockopt"); exit(EXIT_FAILURE);
```

```
}
```

```
address.sin_family = AF_INET; address.sin_addr.s_addr
```

```
= INADDR_ANY; address.sin_port = htons(PORT);
```

```
if(bind(server_fd, (struct sockaddr *)&address, sizeof(address)) < 0) {
```

```
    perror("bind failed"); exit(EXIT_FAILURE);
```

```
}
```

```
if(listen(server_fd, 5) < 0) {
```

```
    perror("listen");
```

```
    exit(EXIT_FAILURE);
```

```
}
```

```
std::cout<< "Secure server is listening on port " << PORT << "..." << std::endl;
```

```
while(true) { intnew_socket; structsockaddr_in
```

```
    client_addr; socklen_t client_addr_len =
```

```
    sizeof(client_addr);
```



```

        if((new_socket = accept(server_fd, (struct sockaddr *)&client_addr, &client_addr_len))
<0){ perror("accept"); std::cerr << "Error on

        accept" << std::endl;

    } else { std::thread(handle_client,

        new_socket).detach();

    }

}

close(server_fd);

return 0;

}

```

## Compilation & Execution Steps

For Windows:

1. Open VS Code and navigate to your server/client directory.
2. Compile using:
 

```
g++ server.cpp -o server.exe -std=c++17 -lws2_32 -pthread g++
client.cpp -o client.exe -std=c++17 -lws2_32 -pthread
```
3. Run the server first, then the client.

For Linux:

1. Open terminal and navigate to the respective folder.
2. Compile using:
 

```
g++ server_linux.cpp -o server -std=c++17 -pthread
```
3. Run the server with ./server and client with ./client.

## Screenshots

The followingscreenshots demonstrate successful compilation, server-client connection, and file transfer:

For Server :

```
chit@DESKTOP-4FRN3QU:~$ cd /mnt/c/Users/USER/file_share_project
chit@DESKTOP-4FRN3QU:/mnt/c/Users/USER/file_share_project$ g++ server/server.cpp -o server/server -lpthread
chit@DESKTOP-4FRN3QU:/mnt/c/Users/USER/file_share_project$ ./server/server
Secure server is listening on port 8080...
Client connected. Waiting for authentication...
Client says (decrypted): AUTH chit wipro2025
Authentication successful.
Client says (decrypted): LIST
Client says (decrypted): PUT test.txt 36
Client says (decrypted): GET test.txt
Client says (decrypted): QUIT
```

For Client :

```
chit@DESKTOP-4FRN3QU:~$ cd /mnt/c/Users/USER/file_share_project
chit@DESKTOP-4FRN3QU:/mnt/c/Users/USER/file_share_project$ g++ client/client.cpp -o client/client
chit@DESKTOP-4FRN3QU:/mnt/c/Users/USER/file_share_project$ ./client/client
Connected to secure server. Please log in.
Username: chit
Password: wipro2025
OK: Auth successful. Welcome!
Type 'LIST', 'GET <file>', 'PUT <file>', or 'QUIT'.
> LIST
Server response:
Files on server:
client_upload.txt
test.txt

> PUT test.txt
Uploading test.txt (36 bytes)...
Server response: OK: Upload successful.
> GET test.txt
Receiving test.txt (36 bytes)...
Download complete: test.txt
> QUIT
chit@DESKTOP-4FRN3QU:/mnt/c/Users/USER/file_share_project$
```

## Conclusion

The Secure File Transfer System effectively demonstrates socket programming principles, file handling, and cross-platform development in C++. The project ensures encrypted communication and user authentication, making it suitable for secure network data exchange. Future enhancements may include SSL integration, GUI-based file management, and improved encryption algorithms.

---