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A Project Report
On
LAN Chat Room
With File Transfer using Winsock

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Introduction

In the world of modern communication, real-time connectivity is crucial. From messaging apps to collaborative platforms, socket-based communication forms the foundation of interaction. This project, *LAN Chat Room with File Transfer using Winsock*, was developed as part of the Network Programming course to provide a practical implementation of TCP/IP networking principles. It focuses on LAN-based multi-client communication using sockets in C++, offering functionalities like real-time messaging, file transfer, and a command-based interface — all within a console application.

Objectives

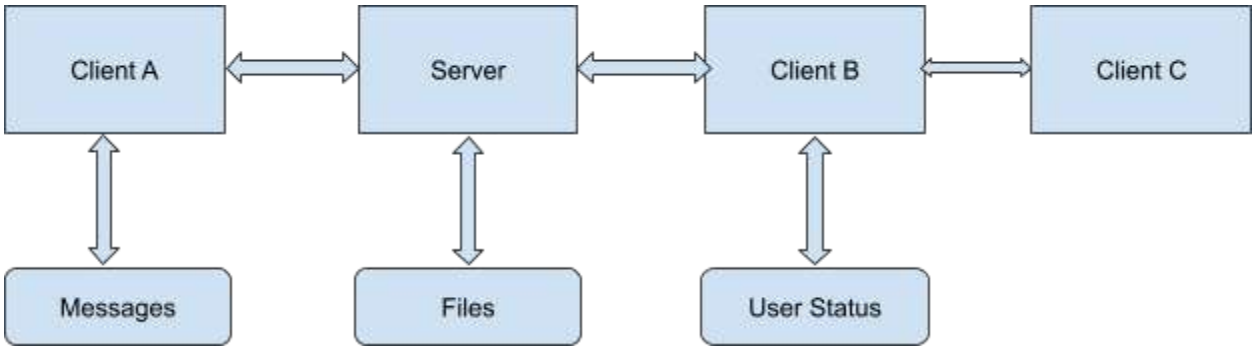
The primary goal of this project is to implement a reliable LAN-based chat system with additional features that mirror real-world messaging platforms. Our objectives include:

- Implementing TCP socket communication using the Winsock API.
- Developing a multi-threaded server capable of handling multiple concurrent clients.
- Creating a client interface for sending and receiving messages in real-time.
- Supporting file transfer between clients via the server.
- Enhancing the console interface with message timestamps and colored outputs.
- Providing essential chat commands like /list, /file, and /exit.

System Architecture

This system is based on a centralized Client-Server model:

- Server:
    - Listens for incoming client connections.
    - Spawns a new thread for each client.
    - Relays messages and file content between clients.
    - Logs all activities (chat and file events) in real-time.
- Client:
    - Connects to the server using IP and port.
    - Sends and receives messages and files.
    - Executes user commands for specific tasks (file transfer, user listing, etc.).



Tools and Technologies Used

Tool/Library	**Purpose**
C++	Core Programming Language
Winsock2 API	Network Programming via TCP/IP
Code::Blocks/VS Code	Development IDE
Windows 11	Operating System
Git	Version Control for code management
MinGW/MSVC	Compiler for building the project
Windows Console API	For colored terminal output

Implementation Overview:

Networking Layer:

The application uses TCP sockets for stable, ordered, and error-checked communication. Winsock2 is initialized on both client and server ends, and proper error handling is implemented.

Concurrency:

The server handles multiple clients using std::thread. Each client connection is managed in its own thread, enabling simultaneous communication without blocking.

Command Interface:

Clients can type standard chat messages or use commands:

- /file filename.txt: Sends a file to other users
- /list: Lists currently connected users
- /exit: Disconnects the client

File Transfer Protocol:

- A special message header FILE:<filename> is sent before sending the actual file.
- The file is sent in binary chunks.
- FILE_END signals the end of file transfer.
- Receiving clients reconstruct and save the file.

User Experience Enhancements:

- Messages are color-coded (e.g., green for own message, yellow for file notices)
- All messages include timestamps like [10:35].
- The client sees their own messages as You: Hello.

Key Features:

Feature	Description
Real-time Chat	Multi-user messaging over LAN
File Transfer Support	Clients can send files through the server
Multi-threaded Server	Each client has a dedicated thread
Colored Terminal Output	Improves clarity and UX
Timestamped Messages	Every message is time-labeled
Self Echo as You:	Sender see You: message instead of name
Safe Disconnection	Clients can gracefully leave with /exit
Server Message Logging	Server sees all messages and file activity

Challenges Faced:

- Concurrency Management: Handling simultaneous clients without data races.
- Partial Transfers: Avoiding incomplete file transfers by enforcing chunking and EOF signaling.
- Crash Prevention: Ensuring the server remains stable even if a client disconnects unexpectedly.
- Text Display: Managing colored output and formatting consistently across different terminals.
- Command Parsing: Cleanly distinguishing between commands and regular messages.

Testing and Results:

Scenarios Tested:

- 2–3 clients chatting simultaneously
- File transfer of .txt, .jpg, and .pdf files
- Stress testing with repeated join/leave
- Edge cases like:
    - File not found
    - File interrupted mid-transfer
    - Invalid commands

Results:

- All messages displayed correctly with timestamps and colors
- Files were successfully transferred between clients
- Commands worked as expected
- Server handled concurrent clients without crashing

Conclusion:

The LAN Chat Room project has successfully demonstrated the power of socket programming using Winsock in C++. We built a multi-user system with messaging and file transfer capabilities, simulating real-time network communication. The enhancements such as colored output, timestamps, and a clean command interface added polish and usability. This project not only met its functional goals but also significantly deepened our understanding of client-server networking and system-level programming.

Future Enhancements:

- Develop a full GUI version of the client using Win32 or Qt
- Implement end-to-end encryption for secure messaging and file sharing
- Add file transfer progress indicators
- Enable LAN auto-discovery using UDP broadcasts
- Store chat logs in files for later retrieval
- Add user authentication or nickname conflict detection

Acknowledgment:

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