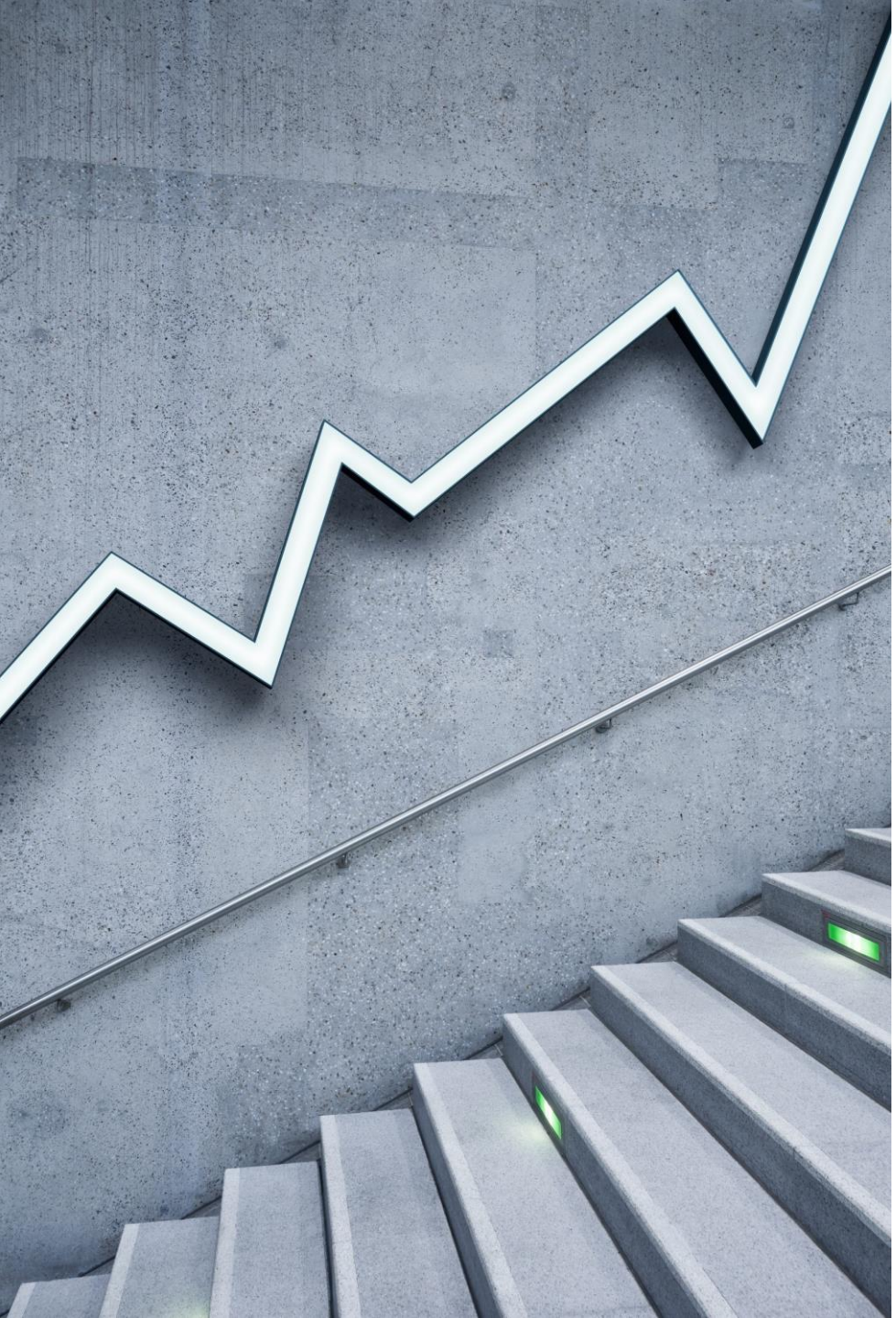

Multi-Threaded Chat Server and Client

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Introduction

- The project involves developing a chat server and client application in Linux using C.
- Key features include user authentication, message formatting with timestamps and server logging.
- The system supports multiple clients simultaneously.

Project Objectives

- Develop a robust chat server and client in C.
- Implement user authentication for secure communication.
- Allow clients to send and receive broadcast and private messages.
- Format messages with timestamps for better readability.
- Log user actions on the server for monitoring and debugging.

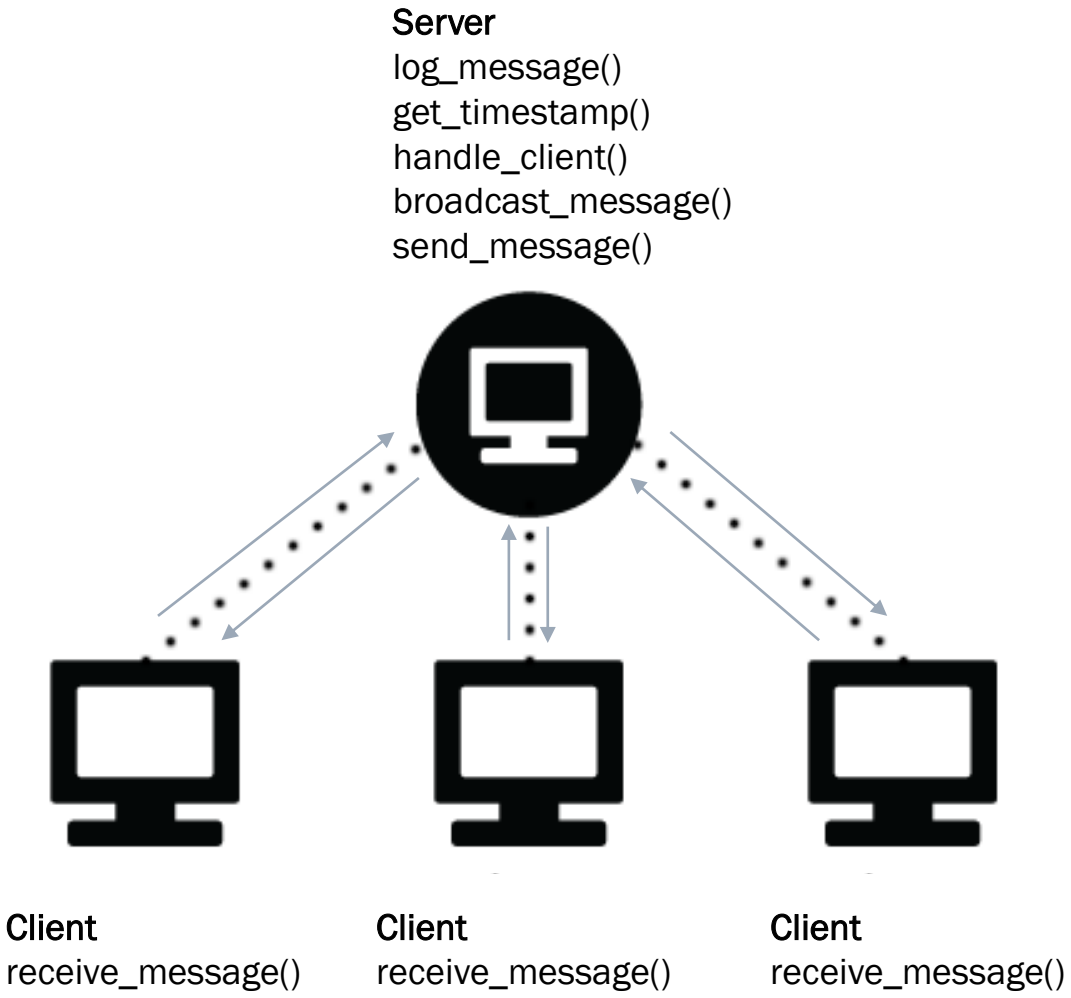
System Design

Chat Server

- log_message()
- get_timestamp()
- handle_client()
- broadcast_message()
- send_message()

Chat Client

- receive_message()



Chat Server Overview

- Handles multiple client connections using threads.
- Authenticates users and assigns usernames.
- Formats and broadcasts messages with timestamps.
- Logs user actions.

Chat Client Overview

- Connects to the server and handles user input.
- Sends messages to the server.
- Displays messages received from the server.
- Supports private messaging.

User authentication

- Users are prompted to enter a username upon connecting.
- Usernames are used to identify clients.
- Ensures secure and personalized communication.

Message Formatting with Timestamps

- Messages are formatted with timestamps before broadcasting.
- Example: [2024-08-07 12:00:05] user1: Hello everyone!
- Helps users track the timing of messages.

Server Logging for User Actions

- Logs various user actions like login, logout, and messages.
- Example log entry: [2024-08-07 12:00:00] User user1 logged in.
- Stored in 'server.log' for monitoring and debugging.

chat_server.c functions

log_message()

- logs user messages and actions to a server.log file
- Parameter – a format string followed by variable arguments
- Functionality – opens log file in append mode, writes current timestamp and formatted message to the log file and then closes the log file

get_timestamp()

- Generates a timestamp string.
  Returns a pointer to a static buffer containing the formatted timestamp
- Gets the current time, converts it to a local time and formats the time as a string ('**YYYY-MM-DD HH:MM:SS**').

handle_client()

- Handles communication with a connected client.
- Parameters – ‘**arg**’ a pointer to struct client
- Prompts user for a username and logs the user’s login.
- Displays a welcome message.
- Receives messages from the client, formats them, and broadcasts them to other clients.
- Logs each message.
- Handles client disconnection, logging the logout and cleaining up of resources.

broadcast_message()

- Broadcasts a message to all connected clients except the sender.
- Parameters- ‘**message**’ to be broadcasted and ‘**exclude_fd**’ the file descriptor of the client to exclude (the sender)
- Iterates over all connected clients and sends message to all clients except ‘**exclude_fd**’.

send_message()

- Sends a message to a specific client.
- Parameters: ‘**fd**’ the file descriptor of the client’s socket.

  ‘**message**’ the message to be sent.
- Sends the message to the client using the ‘**send**’ system call.

main()

- Creates a socket for the server.
- Configures the socket to reuse the address and port.
- Binds the socket to the specified port.
- Listens for incoming client connections.
- Accepts new client connections and spawns a new thread to handle each client.
- Manages client connections using a mutex for thread safety.

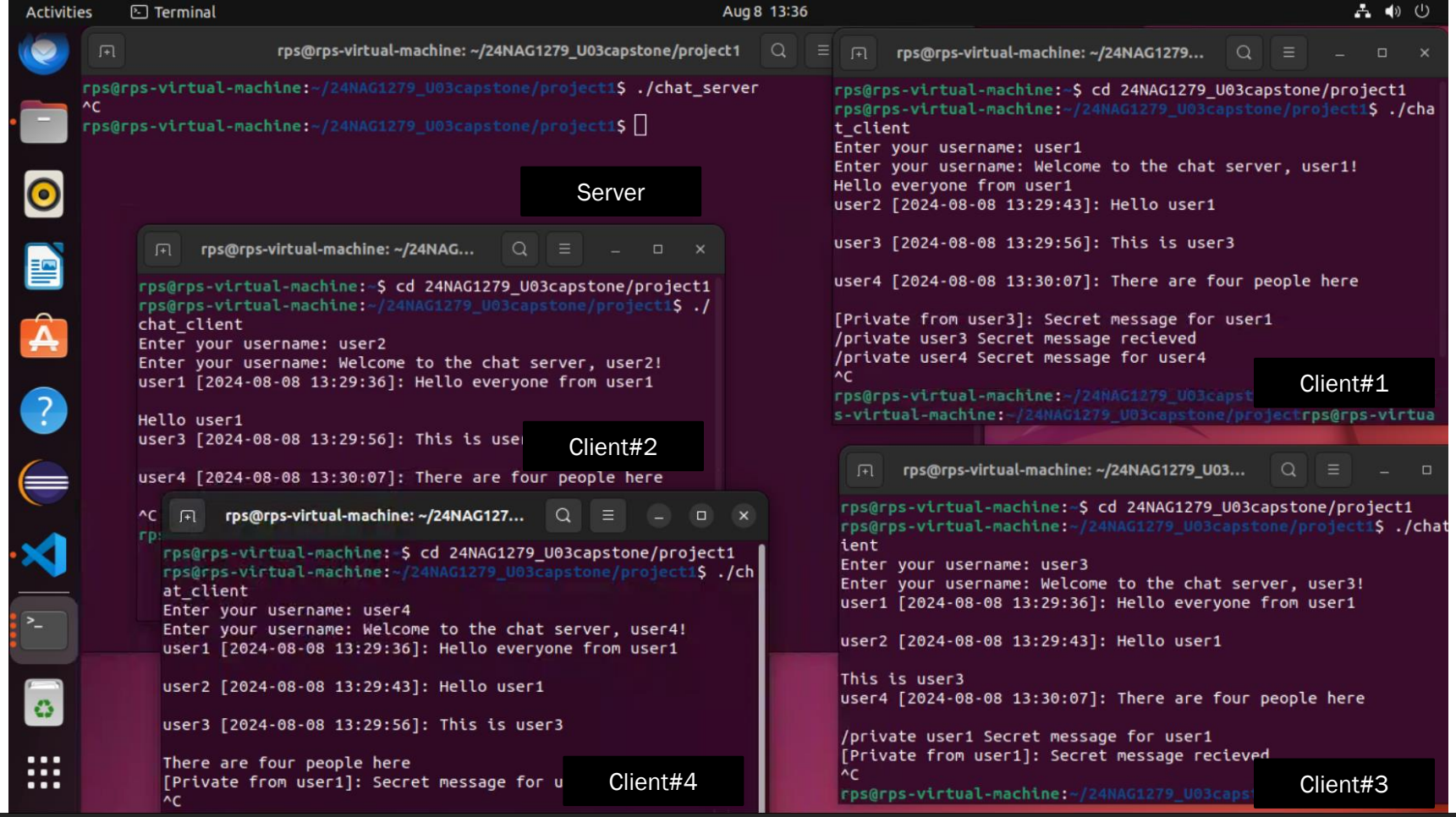
chat_client.c functions

receive_message()

- Continuously receives and displays messages from the server.
- Parameters- ‘**arg**’ a pointer to the socket file descriptor.
- Receives messages from the server in a loop.
- Displays the received messages on the client’s terminal.
- Closes the socket and exits when the server closes the connection.

main()

- Creates a socket for the client.
- Sets up the server address structure.
- Connects to the server using the specified IP address and port.
- Prompts the user to enter a username and sends it to the server.
- Creates a thread to handle incoming messages from the server.
- Continuously reads user input from the terminal and sends it to the server.
- Handles special commands (like private messaging) or regular messages.



Output

Chat Server and 4 Clients

server.log

common.h | chat_server.c 1 | chat_client.c | server.log

server.log

```
2024-08-08 13:27:36 User user1 logged in
2024-08-08 13:27:50 User user2 logged in
2024-08-08 13:28:04 User user3 logged in
2024-08-08 13:28:21 User user4 logged in
2024-08-08 13:29:36 Message from user1: Hello everyone from user1

2024-08-08 13:29:43 Message from user2: Hello user1

2024-08-08 13:29:56 Message from user3: This is user3

2024-08-08 13:30:07 Message from user4: There are four people here

2024-08-08 13:30:28 Message from user3: /private user1 Secret message for user1

2024-08-08 13:30:53 Message from user1: /private user3 Secret message recieved

2024-08-08 13:31:04 Message from user1: /private user4 Secret message for user4

2024-08-08 13:31:21 User user1 logged out
2024-08-08 13:31:27 User user2 logged out
2024-08-08 13:31:32 User user3 logged out
2024-08-08 13:31:35 User user4 logged out
```

Future Enhancements

- Encrypted communication using SSL/TLS.
- Persistent user accounts and password storage.
- Graphical user interface (GUI) for the client application.
- Group chat functionality.
- Message history retrieval.

Conclusion

- Developed a multi-threaded chat server and client with enhanced features.
- Implemented user authentication, message formatting, and server logging.
- The system is scalable and can be extended with additional functionalities.

The End