

# Mandatory Hand-in 3- Chitty Chat

## Streaming

Our system is using bidirectional streaming which can be seen in Illustration 1.1. The illustration shows that when a client uses the SendMessage function of the service, 2 streams are made which is defined as bidirectional streaming.

```
20 service ChittyChatService {  
21     rpc SendMessage (stream Message) returns (stream Message);  
22 }
```

Illustration 1.1: Illustration of function that the service provides.

## System Architecture

The architecture our System uses is a client-server architecture since the clients communicate through a server. If there had been direct communication between the clients, the architecture would be peer-to-peer. Illustration 1.2 shows that the system uses both client and server to function.

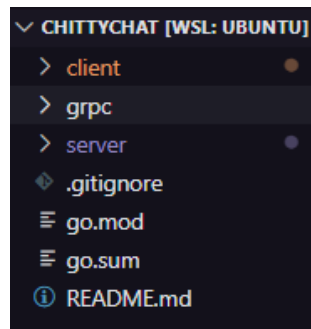


Illustration 1.2: illustration of the systems structure.

## RPC implementation

As seen in Illustration 1.1, the service contains just 1 RPC method that opens a stream from the client to the server and vice versa. This method uses a message with a struct seen in Illustration 1.3. This struct contains a string which is the message the client wants to send, an int32 that represents whether a client is connecting, disconnecting or publishing a message. Another int32 is used for the time.

```

12  message Message {
13      string text = 1;
14      int32 type = 2;
15      int32 time = 3;
16      // time will be represented by Lamport clocks incremented when a message is received or sended
17      ClientReference client_reference = 4;
18  }

```

Illustration 1.3: Illustration of the Message struct

The ClientReference is a struct that contains all the necessary information about the connecting clients, see Illustration 1.4. The ClientReference has a string containing the IP-address of the client. An int32 is used to contain the port where the client is established, and a string is used for saving the clients name for better user friendliness.

```

7  message ClientReference {
8      string client_address = 1;
9      int32 client_port = 2;
10     string client_name = 3;
11 }

```

Illustration 1.4: illustration of ClientReference.

## Calculation of Lamport Timestamps

Every node has a Lamport timestamp. That means both the clients and the server have a Lamport timestamp. Every time an event has occurred on the client, its local timestamp will increment. Before the client sends a message to the server the timestamp will increment, and the incremented timestamp will be sent with the message. The server receives the message and compares the message's timestamp with its local timestamp. The higher timestamp gets saved and incremented. The server then sends the message to the other clients. For each client before sending the message the timestamp will be incremented and sent with message. On the client side when the message is received the message's timestamp will be compared to the local timestamp and the higher timestamp will be saved and incremented.

## Lamport Timestamp Timeline Diagram

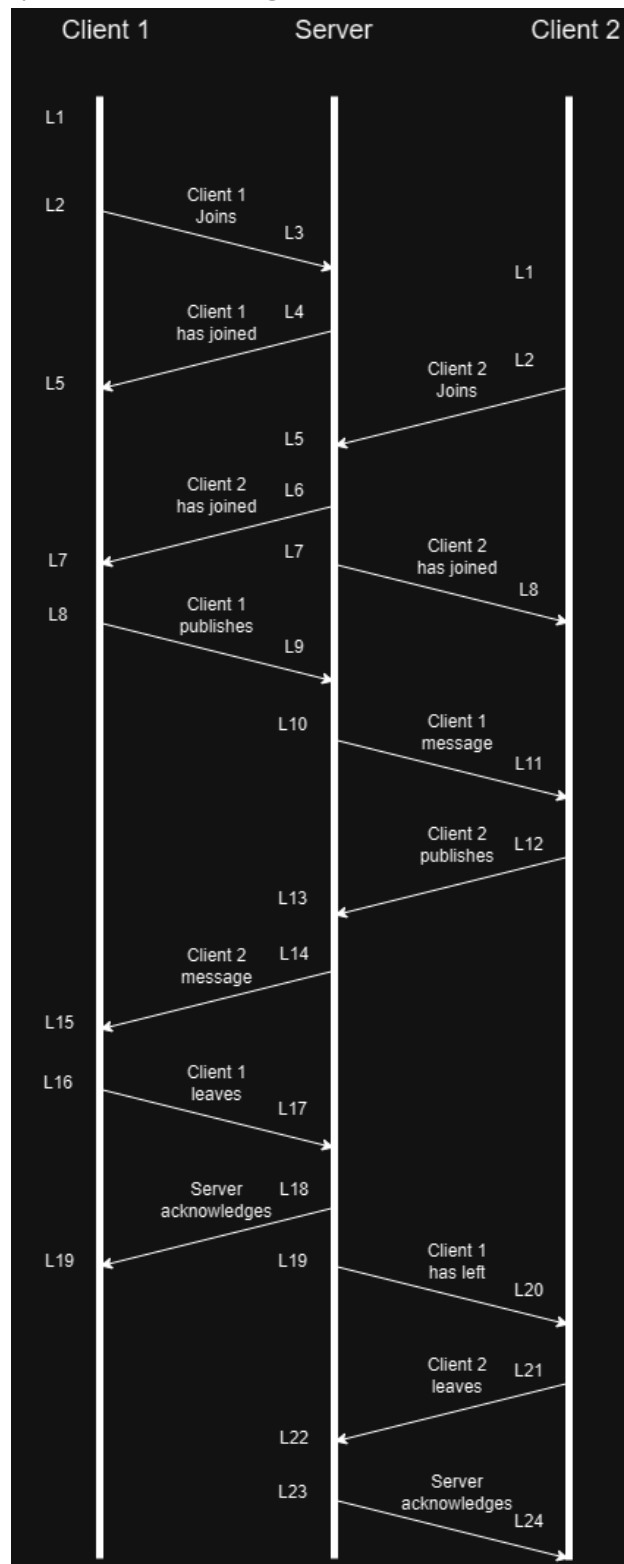


Illustration 1.5: gRPC call diagram

Documentation of the interactions visualized in Illustration 1.5 can be seen in the system logs at appendix 1.

GitHub Repository Link

<https://github.com/rafj58/ChittyChat>

## Appendix

### 1. System logs for gRPC call diagram

Server:

```
2023/10/29 18:31:56 Started server at address: 192.168.40.248 and at port: 8080
2023/10/29 18:32:06 [Lamport time: 3] Client Client1 127.0.0.1:40 has connected
2023/10/29 18:32:06 [Lamport time: 4] Sent message to client: Client1 127.0.0.1:40
2023/10/29 18:32:11 [Lamport time: 5] Client Client2 127.0.0.1:20 has connected
2023/10/29 18:32:11 [Lamport time: 6] Sent message to client: Client1 127.0.0.1:40
2023/10/29 18:32:11 [Lamport time: 7] Sent message to client: Client2 127.0.0.1:20
2023/10/29 18:32:19 [Lamport Time: 9] Received messgae from client: Client1 127.0.0.1:40
2023/10/29 18:32:19 [Lamport time: 10] Sent message to client: Client2 127.0.0.1:20
2023/10/29 18:32:24 [Lamport Time: 13] Received messgae from client: Client2 127.0.0.1:20
2023/10/29 18:32:24 [Lamport time: 14] Sent message to client: Client1 127.0.0.1:40
2023/10/29 18:32:28 [Lamport Time: 17] Received disconnect message from client: Client1 127.0.0.1:40
2023/10/29 18:32:28 [Lamport time: 18] Client Client1 127.0.0.1:40 disconnected
2023/10/29 18:32:28 [Lamport time: 19] Sent message to client: Client2 127.0.0.1:20
2023/10/29 18:32:32 [Lamport Time: 22] Received disconnect message from client: Client2 127.0.0.1:20
2023/10/29 18:32:32 [Lamport time: 23] Client Client2 127.0.0.1:20 disconnected
```

Client 1:

```
2023/10/29 18:32:06 Connected to the server at port 8080
2023/10/29 18:32:06 [Lamport Time: 1] Connected to server
2023/10/29 18:32:06 [Lamport Time: 2] Sent connect message to server
2023/10/29 18:32:06 Enter the content of the message ('exit' to quit):
2023/10/29 18:32:06 [Lamport Time: 5, Name: Client1] Client1 127.0.0.1:40 has joined the chat at Lamport time 3
2023/10/29 18:32:06 Enter the content of the message ('exit' to quit):
2023/10/29 18:32:11 [Lamport Time: 7, Name: Client2] Client2 127.0.0.1:20 has joined the chat at Lamport time 5
2023/10/29 18:32:11 Enter the content of the message ('exit' to quit):
Hello
2023/10/29 18:32:19 Enter the content of the message ('exit' to quit):
2023/10/29 18:32:24 [Lamport Time: 15, Name: Client2] Hi
2023/10/29 18:32:24 Enter the content of the message ('exit' to quit):
exit
```

Client 2:

```
2023/10/29 18:32:11 Connected to the server at port 8080
2023/10/29 18:32:11 [Lamport Time: 1] Connected to server
2023/10/29 18:32:11 [Lamport Time: 2] Sent connect message to server
2023/10/29 18:32:11 Enter the content of the message ('exit' to quit):
2023/10/29 18:32:11 [Lamport Time: 8, Name: Client2] Client2 127.0.0.1:20 has joined the chat at Lamport time 5
2023/10/29 18:32:11 Enter the content of the message ('exit' to quit):
2023/10/29 18:32:19 [Lamport Time: 11, Name: Client1] Hello
2023/10/29 18:32:19 Enter the content of the message ('exit' to quit):
Hi
2023/10/29 18:32:24 Enter the content of the message ('exit' to quit):
2023/10/29 18:32:28 [Lamport Time: 20, Name: Client1] Client1 127.0.0.1:40 has left the chat at Lamport time 18
2023/10/29 18:32:28 Enter the content of the message ('exit' to quit):
exit
```

### 2. Demonstration of 3 running clients, and messages at max 128 characters

Server:

```

rafj@LAPTOP-NR3BIT2S:server$ go run server.go -port 8080
2023/10/31 15:03:36 Started server at address: 192.168.8.113 and at port: 8080
2023/10/31 15:03:49 [Lamport time: 3] Client Anton 127.0.0.1:20 has connected
2023/10/31 15:03:49 [Lamport time: 4] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:03:57 [Lamport time: 5] Client Bjarke 127.0.0.1:40 has connected
2023/10/31 15:03:57 [Lamport time: 6] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:03:57 [Lamport time: 7] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:02 [Lamport time: 8] Client Oliver 127.0.0.1:60 has connected
2023/10/31 15:04:02 [Lamport time: 9] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:04:02 [Lamport time: 10] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:02 [Lamport time: 11] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:04:08 [Lamport Time: 14] Received messgae from client: Oliver 127.0.0.1:60
2023/10/31 15:04:08 [Lamport time: 15] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:04:08 [Lamport time: 16] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:18 [Lamport Time: 19] Received messgae from client: Bjarke 127.0.0.1:40
2023/10/31 15:04:18 [Lamport time: 20] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:04:18 [Lamport time: 21] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:04:23 [Lamport Time: 24] Received messgae from client: Anton 127.0.0.1:20
2023/10/31 15:04:23 [Lamport time: 25] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:23 [Lamport time: 26] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:05:18 [Lamport Time: 27] Received disconnect message from client: Anton 127.0.0.1:20
2023/10/31 15:05:18 [Lamport time: 28] Client Anton 127.0.0.1:20 disconnected
2023/10/31 15:05:18 [Lamport time: 29] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:05:18 [Lamport time: 30] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:05:22 [Lamport Time: 32] Received disconnect message from client: Bjarke 127.0.0.1:40
2023/10/31 15:05:22 [Lamport time: 33] Client Bjarke 127.0.0.1:40 disconnected
2023/10/31 15:05:22 [Lamport time: 34] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:05:25 [Lamport Time: 37] Received disconnect message from client: Oliver 127.0.0.1:60
2023/10/31 15:05:25 [Lamport time: 38] Client Oliver 127.0.0.1:60 disconnected

```

Client 1:

```

rafj@LAPTOP-NR3BIT2S:server$ go run server.go -port 8080
2023/10/31 15:03:36 Started server at address: 192.168.8.113 and at port: 8080
2023/10/31 15:03:49 [Lamport time: 3] Client Anton 127.0.0.1:20 has connected
2023/10/31 15:03:49 [Lamport time: 4] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:03:57 [Lamport time: 5] Client Bjarke 127.0.0.1:40 has connected
2023/10/31 15:03:57 [Lamport time: 6] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:03:57 [Lamport time: 7] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:02 [Lamport time: 8] Client Oliver 127.0.0.1:60 has connected
2023/10/31 15:04:02 [Lamport time: 9] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:04:02 [Lamport time: 10] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:02 [Lamport time: 11] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:04:08 [Lamport Time: 14] Received messgae from client: Oliver 127.0.0.1:60
2023/10/31 15:04:08 [Lamport time: 15] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:04:08 [Lamport time: 16] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:18 [Lamport Time: 19] Received messgae from client: Bjarke 127.0.0.1:40
2023/10/31 15:04:18 [Lamport time: 20] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:04:18 [Lamport time: 21] Sent message to client: Anton 127.0.0.1:20
2023/10/31 15:04:23 [Lamport Time: 24] Received messgae from client: Anton 127.0.0.1:20
2023/10/31 15:04:23 [Lamport time: 25] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:04:23 [Lamport time: 26] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:05:18 [Lamport Time: 27] Received disconnect message from client: Anton 127.0.0.1:20
2023/10/31 15:05:18 [Lamport time: 28] Client Anton 127.0.0.1:20 disconnected
2023/10/31 15:05:18 [Lamport time: 29] Sent message to client: Bjarke 127.0.0.1:40
2023/10/31 15:05:18 [Lamport time: 30] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:05:22 [Lamport Time: 32] Received disconnect message from client: Bjarke 127.0.0.1:40
2023/10/31 15:05:22 [Lamport time: 33] Client Bjarke 127.0.0.1:40 disconnected
2023/10/31 15:05:22 [Lamport time: 34] Sent message to client: Oliver 127.0.0.1:60
2023/10/31 15:05:25 [Lamport Time: 37] Received disconnect message from client: Oliver 127.0.0.1:60
2023/10/31 15:05:25 [Lamport time: 38] Client Oliver 127.0.0.1:60 disconnected

```

Client 2:

```

rafj@LAPTOP-NR3BIT2S:client$ go run client.go -cPort 40 -cName Bjarke -sPort 8080 -sAddr 192.168.8.113
2023/10/31 15:03:57 Connected to the server at port 8080
2023/10/31 15:03:57 [Lamport Time: 1] Connected to server
2023/10/31 15:03:57 [Lamport Time: 2] Sent connect message to server
2023/10/31 15:03:57 [Lamport Time: 8, Name: Bjarke] Bjarke 127.0.0.1:40 has joined the chat at Lamport time 5
2023/10/31 15:03:57 Enter the content of the message ('exit' to quit):
2023/10/31 15:04:02 [Lamport Time: 11, Name: Oliver] Oliver 127.0.0.1:60 has joined the chat at Lamport time 8
2023/10/31 15:04:02 Enter the content of the message ('exit' to quit):
2023/10/31 15:04:08 [Lamport Time: 17, Name: Oliver] Hi
2023/10/31 15:04:08 Enter the content of the message ('exit' to quit):
Good Morning
2023/10/31 15:04:18 Enter the content of the message ('exit' to quit):
2023/10/31 15:04:23 [Lamport Time: 26, Name: Anton] Hello
2023/10/31 15:04:23 Enter the content of the message ('exit' to quit):
2023/10/31 15:05:18 [Lamport Time: 30, Name: Anton] Anton 127.0.0.1:20 has left the chat at Lamport time 28
2023/10/31 15:05:18 Enter the content of the message ('exit' to quit):
exit
2023/10/31 15:05:22 Enter the content of the message ('exit' to quit):

```

### Client 3:

```

rafj@LAPTOP-NR3BIT2S:client$ go run client.go -cName Oliver -cPort 60 -sPort 8080 -sAddr 192.168.8.113
2023/10/31 15:04:02 Connected to the server at port 8080
2023/10/31 15:04:02 [Lamport Time: 1] Connected to server
2023/10/31 15:04:02 [Lamport Time: 2] Sent connect message to server
2023/10/31 15:04:02 [Lamport Time: 12, Name: Oliver] Oliver 127.0.0.1:60 has joined the chat at Lamport time 8
2023/10/31 15:04:02 Enter the content of the message ('exit' to quit):
Hi
2023/10/31 15:04:08 Enter the content of the message ('exit' to quit):
2023/10/31 15:04:18 [Lamport Time: 21, Name: Bjarke] Good Morning
2023/10/31 15:04:18 Enter the content of the message ('exit' to quit):
2023/10/31 15:04:23 [Lamport Time: 27, Name: Anton] Hello
2023/10/31 15:04:23 Enter the content of the message ('exit' to quit):
2023/10/31 15:05:18 [Lamport Time: 31, Name: Anton] Anton 127.0.0.1:20 has left the chat at Lamport time 28
2023/10/31 15:05:18 Enter the content of the message ('exit' to quit):
2023/10/31 15:05:22 [Lamport Time: 35, Name: Bjarke] Bjarke 127.0.0.1:40 has left the chat at Lamport time 33
2023/10/31 15:05:22 Enter the content of the message ('exit' to quit):
exit
2023/10/31 15:05:25 Enter the content of the message ('exit' to quit):

```