

Assignment 3: TCP Handshake (Client Side)

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Overview

This assignment implements the client side of a simplified TCP three-way handshake using raw sockets in C++. The handshake involves the client:

1. Constructing and sending an initial SYN packet (with a sequence number of 200),
2. Waiting for and processing a SYN-ACK response from the server,
3. Sending a final ACK packet (with a sequence number of 600) to complete the handshake.

Compilation Instructions

To compile the client code, open a terminal and navigate to the `cs425-2025/Homeworks/A3` directory (after cloning the repository). Then run the following command:

```
g++ -o client client.cpp -std=c++11
```

Note: Administrative privileges are required because raw socket operations require elevated permissions.

Execution Instructions

After compilation, execute the client code with root privileges. In your terminal, run:

```
sudo ./client
```

The client will perform the following:

- Create a raw socket and prepare a custom TCP SYN packet.
- Send the SYN packet to the server (listening on port 12345) with an initial sequence number of 200.

- Wait for the server's SYN-ACK response and verify the TCP flags and sequence numbers.
- Construct and send a final ACK packet (with sequence number 600) to complete the handshake.

Console output will provide step-by-step feedback of the handshake progress.

Design and Implementation Details

- **Raw Sockets:** The client uses raw sockets to manually construct IP and TCP header fields. The `IP_HDRINCL` socket option is enabled so that our packets include our own IP header.
- **TCP Handshake:**
 - *SYN:* The client constructs the SYN packet with source port 1000, destination port 12345, and sequence number 200.
 - *SYN-ACK:* Upon receiving the SYN-ACK (with expected sequence number and flags), the client verifies the TCP flags.
 - *ACK:* The client then sends an ACK with a sequence number of 600 and the appropriate acknowledgement number.
- **Documentation:** Detailed inline comments in the source code explain each step during packet construction, transmission, and reception.

Individual Contributions

- **Kumar Kanishk Singh (210544):** Implemented the raw socket functions and packet construction for the SYN and ACK packets.
- **Sunny Raja Prasad (218171078):** Developed the code for receiving and parsing incoming packets and integrating the handshake sequence.
- **Tanmey Agarwal (211098):** Integrated and tested the complete client-side handshake implementation; prepared documentation and the README file.

Sources

- Server code and project repository from <https://github.com/privacy-iitk/cs425-2025.git>.
- Raw sockets programming references and documentation (e.g., <https://www.tcpdump.org/manpages/>).
- Online tutorials and lecture notes from CS425.

Declaration

We hereby declare that the work presented in this assignment is our own. We have not copied any portion of this assignment from any other source without proper citation, and all external sources have been acknowledged in the Sources section. We understand that violations of this policy may result in disciplinary action.

Feedback

We welcome any feedback regarding the assignment and our implementation. Please forward any comments or suggestions to the course staff via Piazza.