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A close up of a sign

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**COMP 4320**

**Introduction to Computer Networks**

Project #: Lab 2

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10/6/2025

# Executive Summary

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This section should begin on a new page. The executive summary should include a summary of the findings and decisions

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# 1 Part 1 – TCP

## 1.1 Beginning Questions

1. My IP address is 172.17.48.138 and my port number is 64701.A screenshot of a computer

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2. The server IP address is 217.21.95.185. It’s port number is 80.A screenshot of a computer

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## 1.2 TCP Basics

1. The segment that initiates the connection has a relative sequence number of 0. It can be identified by how it says [SYN] and Seq=0 in the info.A screenshot of a computer

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2. The sequence number of the reply is 0. The value of the acknowledgement field is 1. Since the seq value was 0, the ack value was +1, resulting in the value 1. [SYN, ACK] in the info identifies it as a SYNACK segment.A screenshot of a computer screen

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3. The sequence number of the segment containing the POST command was 149055.

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4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Segment | Seq | Time | RTT | Ack Time | EstimatedRTT |
| 403 | 1 | 6.425416 | 0.288396000 | 6.137020 | 0.288396000 |
| 404 | 1 | 6.425418 | 0.288295000 | 6.137123 | 0.288383375 |
| 405 | 1 | 6.428940 | 0.291726000 | 6.137214 | 0.288801203 |
| 406 | 1 | 6.428941 | 0.291700000 | 6.137241 | 0.289163553 |
| 407 | 1 | 6.431449 | 0.293985000 | 6.137464 | 0.289766234 |
| 408 | 1 | 6.431451 | 0.293965000 | 6.137486 | 0.290291079 |

5. The length is 0

A screen shot of a computer

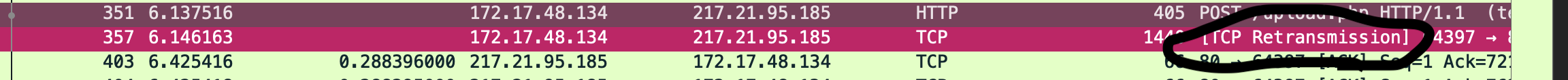
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6. The minimum window size was 743 with a calculated window size of 95104. There was never any throttling.

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7. Yes, there was one retransmission. It says it in the info section

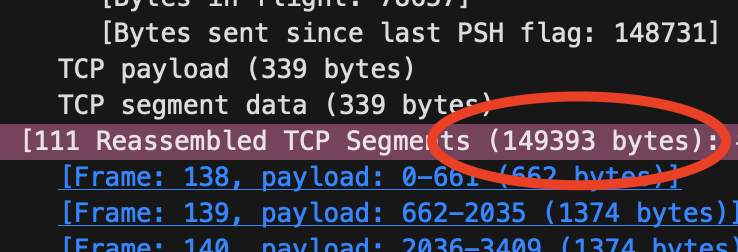


8. In the ACK for one request, the window size was about 2054. I did not find instances of skipping.

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9. The first data segment sent was 6.137516s and the last ACK that confirms the final byte was 6.431453s. 6.431453 − 6.137516 = 0.293937 s. The total amount of bytes in the POST was 149,393 bytes.  
149,393 bytes / 0.293937 s = 508,248 B/s.



## 1.2 TCP congestion control in action

1. The low start is visible from about 0.28 s through 1.34 s. The upload completes before any transition to congestion avoidance. Unlike the ideal model, it starts with a larger initial window and shows irregular growth.

A graph with a line drawn on it

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# 2 Part 2 - UDP

### 1. There are four fields: 4 fields: Source Port, Destination Port, Length and Checksum.

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2. Each UDP header field is 2 bytes. The total header size is 8 bytes

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3. It is the size of the headers (8 bytes) and the size of the data (4 bytes). The 8 + 4 = Length 12.

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4. The max IPv4 size is 65,535 bytes. The IPV4 header is 20 bytes. The UDP header is 8 bytes. 65,535 − 20 − 8 = 65,507 total bytesA screenshot of a computer

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5. The largest possible value is 65,535.

6. UDP’s IP protocol number is 17 (decimal) = 0x11 (hex)

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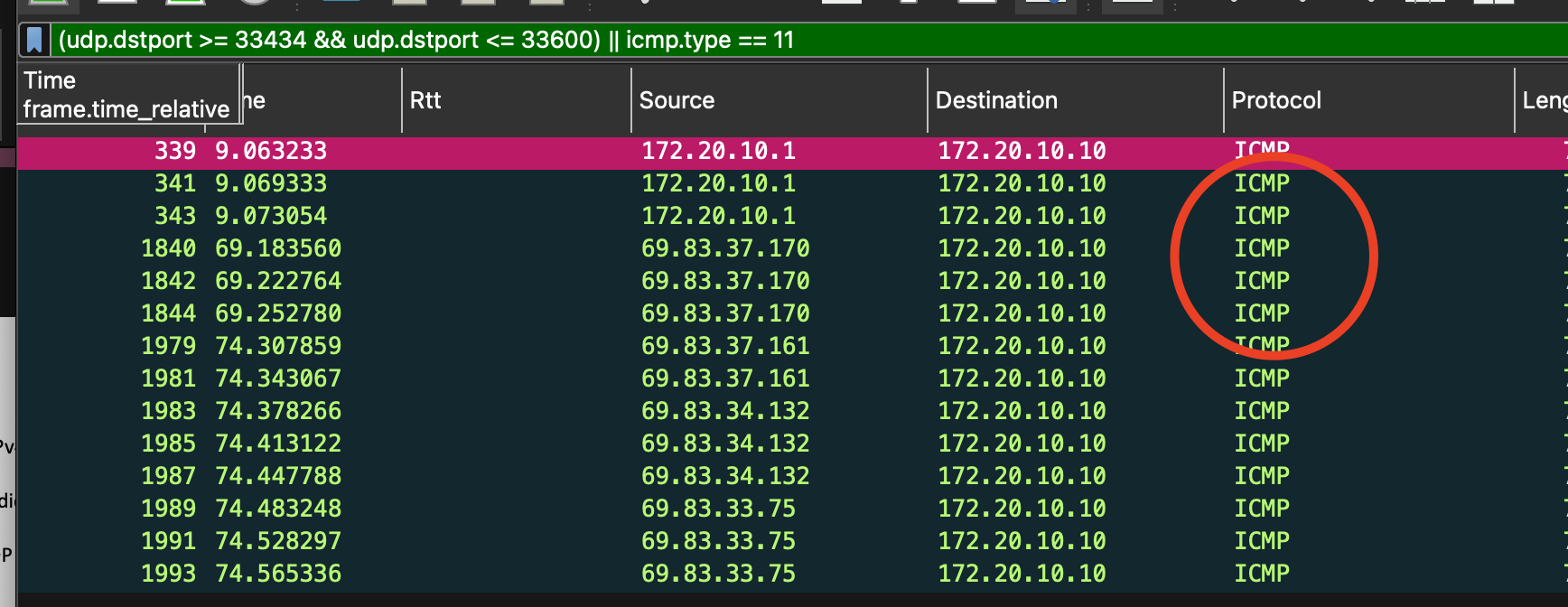
7. The source and destination ports flip values between the packets

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# 3 Part 3 - IPv4 vs IPv6 Traceroute

1. I used the commands “sudo traceroute -P icmp google.com” for IPv4 and “sudo traceroute6 -I www.google.com” for IPv6. The commands listed in the lab manual did not work for me, but I found equivalent commands for my MacBook. They both output ICMP echo probes.



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# 2. IPv4 took 27 hops and IPv6 took 22 hops. The IPv4 path is 5 hops longer than the IPv6 path.

3. For hop 14, IPv6 ≈ 61.07 ms vs IPv4 ≈ 41.53 ms and for hop 12, IPv6 ≈ 57.88 ms vs IPv4 ≈ 40.36 ms. One possible reason for the difference is due to different routing domains on v6. The v6 path shows AT&T/Google v6 prefixes, while v4 went through Verizon/AlterNet before Google.

4. For IPv4, the TTL is 1 and the other values are 0x00 → DSCP: CS0, ECN: Not-ECT. For IPv6, the Flow Label is 0x70000, the Traffic Class is 0x00 (DSCP CS0, ECN Not-ECT). Both things prevent packets from looping endlessly in the network by limiting how many hops they can take.

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5. The \* entries means that one or more routers did not send a response. One reason for this is because of ICMPv6 Time Exceeded errors.

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6. IPv4 run ended at mh-in-f138.1e100.net. IPv6 run ended at mg-in-f99.1e100.net (2607:f8b0:4024:c09::63). The different hostnames indicates that they are probably different anycast locations. The different RTTs are fairly similar.

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# 4 Acknowledgements

This section allows authors to acknowledge contributors and other sources that are not appropriate to list in the references section.

# 5 References

This is the last section of the report, prior to any appendices. The references should not be double-spaced, but single-spaced. For a technical report, use the CSE style.

[1] Reference 1 information.

[2] Reference 2 information.

[3] Reference 3 information.

# 6 AI Use Reflation Statement

As part of this assignment, you are required to explain how Artificial Intelligence (AI) tools were used in your work. For this you need to describe:

* Purpose of Use – Why you chose to use AI (for example: brainstorming, outlining, checking grammar, simplifying complex ideas, or generating examples).
* Extent of Use – To what degree AI contributed (for example: “I used AI to help refine my outline, but the analysis and arguments were entirely my own”).
* My Contribution – How I ensured the final assignment represents my own original thinking, understanding, and interpretation.

Reflections – What I found useful, what limitations I noticed, and how AI influenced my learning process.

**By writing this reflection, I acknowledge that AI is a support tool, not a substitute for my own effort, and I take full responsibility for the final submission.**