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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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10/17/2025

# Executive Summary

This report analyzes the behavior of TCP, UDP, and IPv4/IPv6 protocols using Wireshark packet captures and traceroute tests.

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# 1 Part 1 – TCP

## 1.1 Beginning Questions

1. My IP address is 192.191.190.193 and my port number is 56100.A screenshot of a computer

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2. The server IP address is 217.21.95.185. The 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 computer screen with a red circle

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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.

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3. The sequence number of the segment containing the POST command was 148359.

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4.

A computer screen with numbers and a red circle

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The POST segment has relative sequence number 148359, was sent at 7.617598 s, its first ACK arrived at 7.929438 s, so the RTT = 7.929438 − 7.617598 = 0.311840 s. The initial EstimatedRTT = 311.84 ms

5. The length is 1035.

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6. The minimum calculated window size was 30208. There was never any throttling through window size 0.

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7. There were no retransmissions.

8. The first covering ACK has acknowledgment number 149,394 and it acknowledges 149,394 bytes in total.   
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9. 149,393 bytes over 0.311840 s gives throughput ≈ 479,069 B/s ≈ 468 KB/s ≈ 3.83 Mb/s.

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## 1.3 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.

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# 2 Part 2 – UDP

## 2.1 UDP Packet Information

## 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) A screenshot of a computer

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

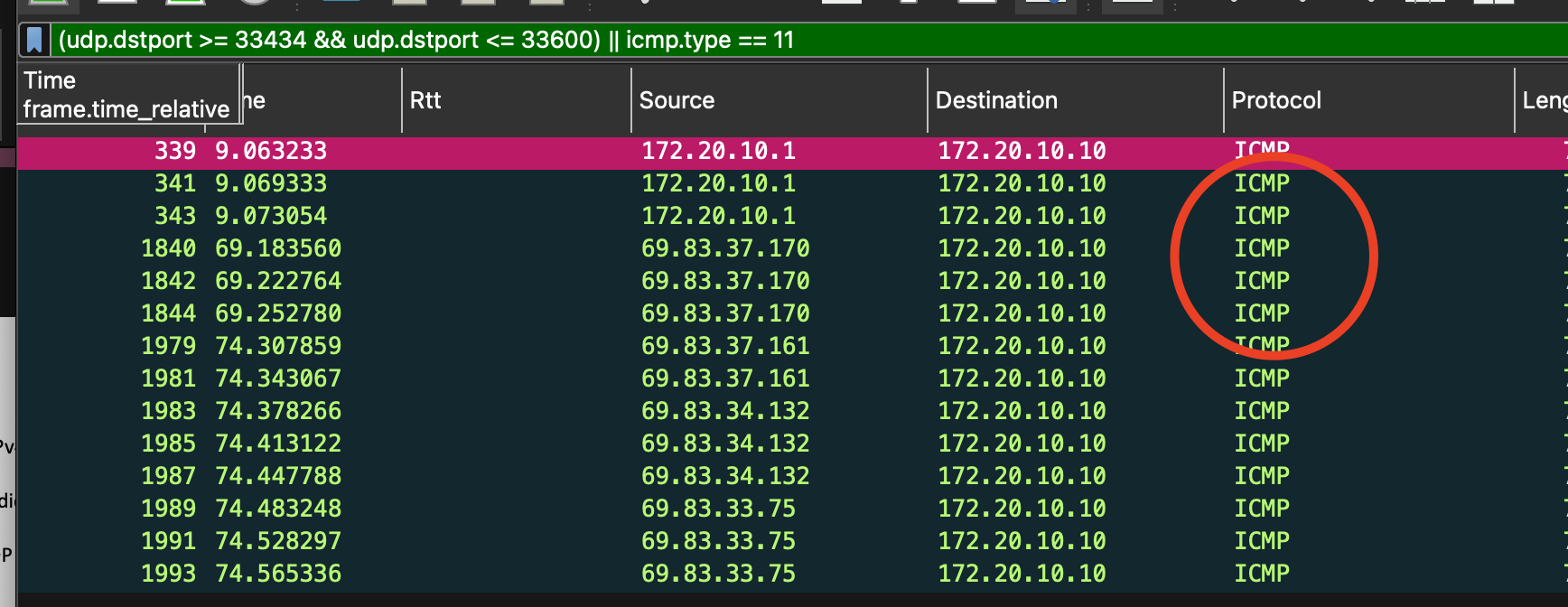
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# 3 Part 3 - Traceroute

## 3.1 IPv4 vs IPv6

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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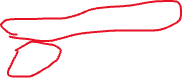
2. IPv4took27 hopsandIPv6took22 hops**.** The IPv4 path is 5 hops longer than the IPv6 path.

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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# 4 AI Use Reflation Statement

I used ChatGPT to help explain some of the concepts of the lab like UDP, and IPv4 vs IPv6. I also used it to help generate Wireshark commands that could filter down to relevant packets that I wanted to find. I wrote all of the answers in this report. I found that ChatGPT was good at high level explanations, but it did hallucinate some non-existent features in Wireshark.

**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.**