

HW2 Report: Ping and Traceroute

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Course: Computer Networks

Assignment: HW2

1. Overview

This assignment implements ICMP Ping and Traceroute utilities using raw sockets in Python. The goal was to replicate the functionality of the system `ping` and `traceroute` commands while handling packet construction, TTL manipulation, RTT calculation, and ICMP message parsing manually.

2. my_ping.py

Features Implemented

- ICMP Echo Request packet creation
- Checksum calculation
- ICMP Echo Reply handling
- Round Trip Time (RTT) calculation
- Support for command-line flags:
 - `-c` (number of packets)
 - `-t` (timeout)

Screenshot my_ping.py

```
siddhi221@Siddhis-MacBook-Air ASSIGN02 % sudo python3 my_ping.py google.com -c 5 -t 1
Password:
PING google.com (142.250.217.238) 56 data bytes
sent icmp_seq=1 at 1772215018.463826
received packet from 142.250.217.238 in 15.57 ms
Overall timeout reached. Exiting.
siddhi221@Siddhis-MacBook-Air ASSIGN02 %
```

```
[siddhi221@Siddhis-MacBook-Air Assign02 % sudo python3 my_ping.py google.com -t 30
PING google.com (142.251.211.78) 56 data bytes
sent icmp_seq=1 at 1772233309.292250
received packet from 142.251.211.78 in 19.61 ms
sent icmp_seq=2 at 1772233310.316995
received packet from 142.251.211.78 in 19.53 ms
sent icmp_seq=3 at 1772233311.337277
received packet from 142.251.211.78 in 19.21 ms
sent icmp_seq=4 at 1772233312.361672
received packet from 142.251.211.78 in 18.26 ms
siddhi221@Siddhis-MacBook-Air Assign02 %
```

```
[siddhi221@Siddhis-MacBook-Air Assign02 % sudo python3 my_ping.py google.com -i 3
PING google.com (142.251.211.78) 56 data bytes
sent icmp_seq=1 at 1772233242.325595
received packet from 142.251.211.78 in 16.95 ms
sent icmp_seq=2 at 1772233245.347697
received packet from 142.251.211.78 in 15.99 ms
sent icmp_seq=3 at 1772233248.369112
received packet from 142.251.211.78 in 16.00 ms
sent icmp_seq=4 at 1772233251.386503
received packet from 142.251.211.78 in 58.49 ms
siddhi221@Siddhis-MacBook-Air Assign02 %
```

3. my_traceroute.py

Features Implemented

- Increment TTL for each hop
- Detect ICMP Time Exceeded messages
- Display hop IP address
- Display RTT for each probe
- Support for command-line flags:
 - **-n** (numeric output only)
 - **-q** (number of queries per hop)
 - **-S** (custom flag implemented)

Screenshots my_traceroute.py

```
siddhi221@Siddhis-MacBook-Air ASSIGN02 % sudo python3 my_traceroute.py -S google.com
traceroute to google.com (142.250.217.238), 30 hops max
 1 10.3.46.1 102.591 ms 4.610 ms 4.335 ms
 2 168.92.252.17 4.339 ms 4.010 ms 3.955 ms
 3 168.92.252.1 15.001 ms 15.167 ms 15.227 ms
 4 et-6-0-9.edge2.newyork6.level3.net (4.68.11.221) 15.929 ms 15.527 ms 15.520 ms
 5 15169-3356-nyc.sp.lumen.tech (4.68.68.146) 15.815 ms 20.355 ms 15.911 ms
 6 * * * (3/3 probes unanswered)
 7 108.170.236.90 19.451 ms 17.119 ms 15.513 ms
 8 192.178.106.18 18.135 ms 17.399 ms 104.753 ms
 9 * * * (3/3 probes unanswered)
10 pnlgaa-ay-in-f14.1e100.net (142.250.217.238) 19.384 ms 17.010 ms 16.025 ms
siddhi221@Siddhis-MacBook-Air ASSIGN02 %
```

```
siddhi221@Siddhis-MacBook-Air ASSIGN02 % sudo python3 my_traceroute.py -S -q 3 google.com
traceroute to google.com (142.250.217.238), 30 hops max
 1 10.3.46.1 7.153 ms 3.998 ms 3.145 ms
 2 168.92.252.17 4.211 ms 3.363 ms 3.271 ms
 3 168.92.252.1 15.039 ms 15.283 ms 15.172 ms
 4 et-6-0-9.edge2.newyork6.level3.net (4.68.11.221) 17.585 ms 15.536 ms 15.473 ms
 5 15169-3356-nyc.sp.lumen.tech (4.68.68.146) 15.272 ms 15.045 ms 16.835 ms
 6 * * * (3/3 probes unanswered)
 7 142.251.60.232 70.060 ms 16.775 ms 16.746 ms
siddhi221@Siddhis-MacBook-Air ASSIGN02 %
```

```
siddhi221@Siddhis-MacBook-Air ASSIGN02 % sudo python3 my_traceroute.py -q 5 google.com
traceroute to google.com (142.250.217.238), 30 hops max
 1 10.3.46.1 2.742 ms 2.634 ms 2.932 ms 3.151 ms 4.184 ms
 2 168.92.252.17 3.201 ms 3.439 ms 3.185 ms 3.255 ms 92.042 ms
 3 168.92.252.1 15.114 ms 15.133 ms 15.098 ms 16.019 ms 15.914 ms
 4 et-6-0-9.edge2.newyork6.level3.net (4.68.11.221) 15.675 ms 16.311 ms 22.715 ms 17.230 ms 15.629 ms
 5 15169-3356-nyc.sp.lumen.tech (4.68.68.146) 16.450 ms 15.909 ms 16.070 ms 15.965 ms 15.839 ms
 6 * * * * *
 7 pnlgaa-ay-in-f14.1e100.net (142.250.217.238) 19.412 ms 16.551 ms 15.946 ms 18.428 ms 15.998 ms
siddhi221@Siddhis-MacBook-Air ASSIGN02 %
```

```
siddhi221@Siddhis-MacBook-Air ASSIGN02 % sudo python3 my_traceroute.py -n google.com
traceroute to google.com (142.250.217.238), 30 hops max
 1 10.3.46.1 6.893 ms 3.385 ms 3.185 ms
 2 168.92.252.17 3.301 ms 3.205 ms 91.594 ms
 3 168.92.252.1 15.060 ms 14.975 ms 15.283 ms
 4 4.68.11.221 16.539 ms 15.539 ms 16.079 ms
 5 4.68.68.146 16.996 ms 16.064 ms 16.057 ms
 6 * * *
 7 142.251.65.102 19.694 ms 16.422 ms 17.193 ms
 8 142.250.224.247 17.203 ms 16.591 ms 16.773 ms
 9 216.239.62.196 19.279 ms 16.194 ms 16.635 ms
```

```
siddhi221@Siddhis-MacBook-Air Assign02 % traceroute google.com
traceroute to google.com (142.251.211.78), 64 hops max, 40 byte packets
 1 10.3.46.1 (10.3.46.1) 52.034 ms 3.817 ms 3.646 ms
 2 168.92.252.17 (168.92.252.17) 3.031 ms 3.363 ms 3.410 ms
 3 168.92.252.1 (168.92.252.1) 17.470 ms 15.588 ms 16.673 ms
 4 et-6-0-9.edge2.newyork6.level3.net (4.68.11.221) 17.256 ms 32.115 ms 27.668 ms
 5 15169-3356-nyc.sp.lumen.tech (4.68.68.146) 23.861 ms 27.038 ms 25.974 ms
 6 * * *
 7 142.251.60.178 (142.251.60.178) 19.772 ms
   142.251.60.234 (142.251.60.234) 16.585 ms
   142.251.64.6 (142.251.64.6) 16.936 ms
 8 216.239.49.65 (216.239.49.65) 20.298 ms
   216.239.43.155 (216.239.43.155) 17.749 ms 19.334 ms
 9 pnlgaa-av-in-f14.1e100.net (142.251.211.78) 16.927 ms 16.648 ms 17.007 ms
siddhi221@Siddhis-MacBook-Air Assign02 % sudo traceroute -I google.com
[Password:
traceroute to google.com (142.251.211.78), 64 hops max, 48 byte packets
 1 10.3.46.1 (10.3.46.1) 6.357 ms 3.703 ms 3.401 ms
 2 168.92.252.17 (168.92.252.17) 3.740 ms 3.576 ms 3.269 ms
 3 168.92.252.1 (168.92.252.1) 15.020 ms 15.061 ms 16.170 ms
 4 et-6-0-9.edge2.newyork6.level3.net (4.68.11.221) 16.875 ms 19.529 ms 18.355 ms
 5 15169-3356-nyc.sp.lumen.tech (4.68.68.146) 16.075 ms 16.639 ms 16.855 ms
 6 108.170.226.183 (108.170.226.183) 16.106 ms 15.824 ms 16.082 ms
 7 216.239.49.65 (216.239.49.65) 16.414 ms 16.133 ms 16.060 ms
 8 pnlgaa-av-in-f14.1e100.net (142.251.211.78) 15.783 ms 15.895 ms 102.099 ms
siddhi221@Siddhis-MacBook-Air Assign02 %
```

4. Notes

- Raw sockets require administrative privileges.
- Some hops may display * if no response is received.
- Results may vary depending on network configuration and firewall policies.

5. Conclusion

This project provided hands-on experience with ICMP packet construction, TTL-based routing discovery, and low-level network programming using Python raw sockets.