MSCS-631: Python Lab 4: ICMP

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GitHub Repository: https://github.com/Oishani/MSCS631_PythonLab4

Lab 4: ICMP

Analysis of RTT Measurements

Three of our targets - Google (North America), Oxford University (Europe), and University of Melbourne (Australia) - all responded in about 15–19 ms, despite being nominally on different continents. That tight clustering shows they're being served from anycast/CDN edge nodes close to us rather than from their origin datacenters. In contrast, the ping to Tsinghua University averaged ≈ 199 ms, which aligns with the true physical distance and routing delay from our location to China.

Reflection on the Lab Experience

This lab was a great hands-on introduction to raw-socket programming in Python and the mechanics of ICMP echo requests. Implementing the checksum by hand and unpacking the IP/ICMP headers reinforced how low-level network protocols operate. Embedding a timestamp in the ICMP payload and calculating one-way delays demonstrated how even a simple tracer tool must carefully manage byte order, packet structure, and timing to produce meaningful measurements.

Challenges Encountered

The hardest part was finding hosts that actually responded from their true datacenter. Most well-known sites now sit behind global CDNs, so they all returned the same ~17 ms edge latency. Installing and running under Python 2 (to match the skeleton's `ord`-based checksum), invoking the script with `sudo`, and coordinating clean screenshots (ensuring at least four replies per run before hitting Ctrl-C) also required several rounds of trial-and-error. Only Tsinghua University target yielded the high latency I expected for a genuine inter-continental measurement.

Screenshots

```
akshatphumbhra@Akshats-MacBook-Pro MSCS631_PythonLab4 % sudo python2 pinger.py
Password:
Pinging 142.250.72.174 using Python:

Reply from 142.250.72.174: time=15.63 ms
Reply from 142.250.72.174: time=18.34 ms
Reply from 142.250.72.174: time=19.02 ms
Reply from 142.250.72.174: time=17.34 ms
Reply from 142.250.72.174: time=18.40 ms
Reply from 142.250.72.174: time=16.94 ms
```

Ping to 142.250.72.174 (google.com, North America)

```
akshatphumbhra@Akshats-MacBook-Pro MSCS631_PythonLab4 % sudo python2 pinger.py
Pinging 172.67.20.89 using Python:

Reply from 172.67.20.89: time=15.58 ms
Reply from 172.67.20.89: time=16.79 ms
Reply from 172.67.20.89: time=18.58 ms
Reply from 172.67.20.89: time=15.14 ms
Reply from 172.67.20.89: time=18.45 ms
Reply from 172.67.20.89: time=15.11 ms
Reply from 172.67.20.89: time=14.19 ms
```

Ping to 172.67.20.89 (ox.ac.uk, Europe)

```
akshatphumbhra@Akshats-MacBook-Pro MSCS631_PythonLab4 % sudo python2 pinger.py
Pinging 101.6.15.66 using Python:

Reply from 101.6.15.66: time=206.80 ms
Reply from 101.6.15.66: time=199.02 ms
Reply from 101.6.15.66: time=199.11 ms
Reply from 101.6.15.66: time=195.30 ms
Reply from 101.6.15.66: time=197.52 ms
Reply from 101.6.15.66: time=198.91 ms
```

Ping to 101.6.15.66 (tsinghua.edu.cn, Asia)

```
akshatphumbhra@Akshats-MacBook-Pro MSCS631_PythonLab4 % sudo python2 pinger.py
Pinging 2.58.104.10 using Python:

Reply from 2.58.104.10: time=16.42 ms
Reply from 2.58.104.10: time=16.46 ms
Reply from 2.58.104.10: time=17.25 ms
Reply from 2.58.104.10: time=18.93 ms
Reply from 2.58.104.10: time=21.44 ms
Reply from 2.58.104.10: time=17.70 ms
```

Ping to 2.58.104.10 (unimelb.edu.au, Australia)