Networking Fundamentals Presentation

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Chennai, April 25, 2025

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Assignment 3 Presentation

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Topics Covered

- ICMP - What, Why, How?
- Ping
- Traceroute

ICMP - What, Why, How?

- The Internet Control Message Protocol**(ICMP)** was conceived as a vital component of the **Internet Protocol Suite**, introduced in 1981 with RFC 792.
- **The main purpose of ICMP is to report errors**.
- For instance, if a problem is occurring because the packets of data are too large, and the router is not capable of handling them, the router is going to discard the data packets and send an ICMP message to the sender. That way, it informs the sending device of the issue.
- **ICMP is commonly used as a diagnostic tool.**

ICMP - What, Why, How?

Traceroute and **Ping**, are two popular utilities that use **ICMP**. They both send messages regarding whether data was successfully transmitted.

Ping

The Ping command tests the **speed** of the connection between two different points, and in the report, we can see precisely **how long it takes** a packet of data to reach its target and return to the sender's device.

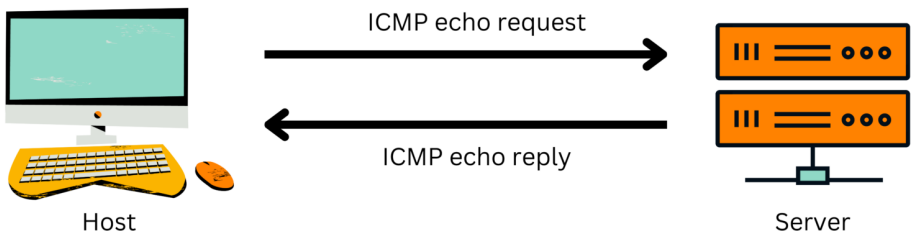
Traceroute

The Traceroute command shows the **actual physical path of the connected routers** that handle and pass the request until it reaches its target destination. Each trip from one router to another is called a **"hop."** The Traceroute command also reveals how much time it took for each hop along the way.

ICMP - What, Why, How?

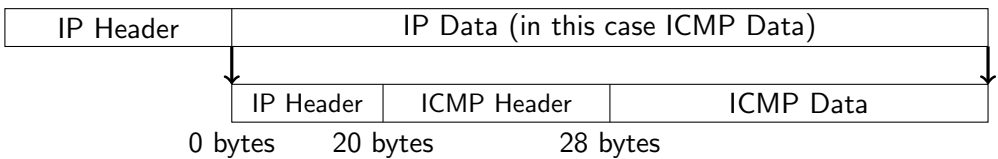
- Internet Control Message Protocol**(ICMP)** stands as one of the leading protocols of the IP suite.
- **BUT,** it is not associated with any transport layer protocol, like **TCP** or **UDP**.
- ICMP is one of the **connectionless protocols**, like UDP.

Internet Control Message Protocol



ICMP - What, Why, How?

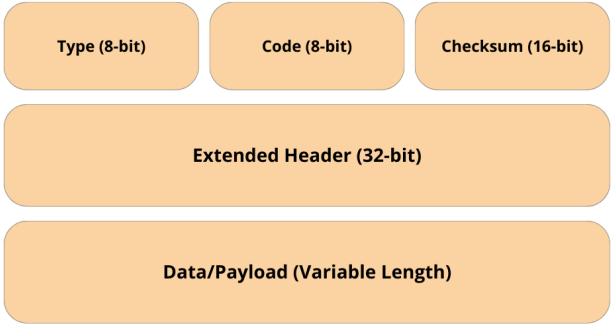
- All ICMP messages are sent as **datagrams** and include an **IP header** that holds the ICMP data.
- ICMP packets are **IP packets** with ICMP in the **IP data part.**
- ICMP messages also **include the complete IP header** from the original message. That way, the target system understands which precise packet failed.
- ICMP is designed to be used **within IP** packets.



ICMP - What, Why, How?

- In the ICMP packet format, the first 32 bits **(4 bytes)** of the packet are divided into three fields:
  - **Type**(8-bit)
  - **Code**(8-bit)
  - **Checksum**(16-bit)

ICMP Packet Format



Ping

- **"Ping"** sends Internet Control Message Protocol (ICMP) packets to the destination.
- Then it waits for the echo reply **"Pong"**.
- It can show statistic for this request, errors and packet loss.

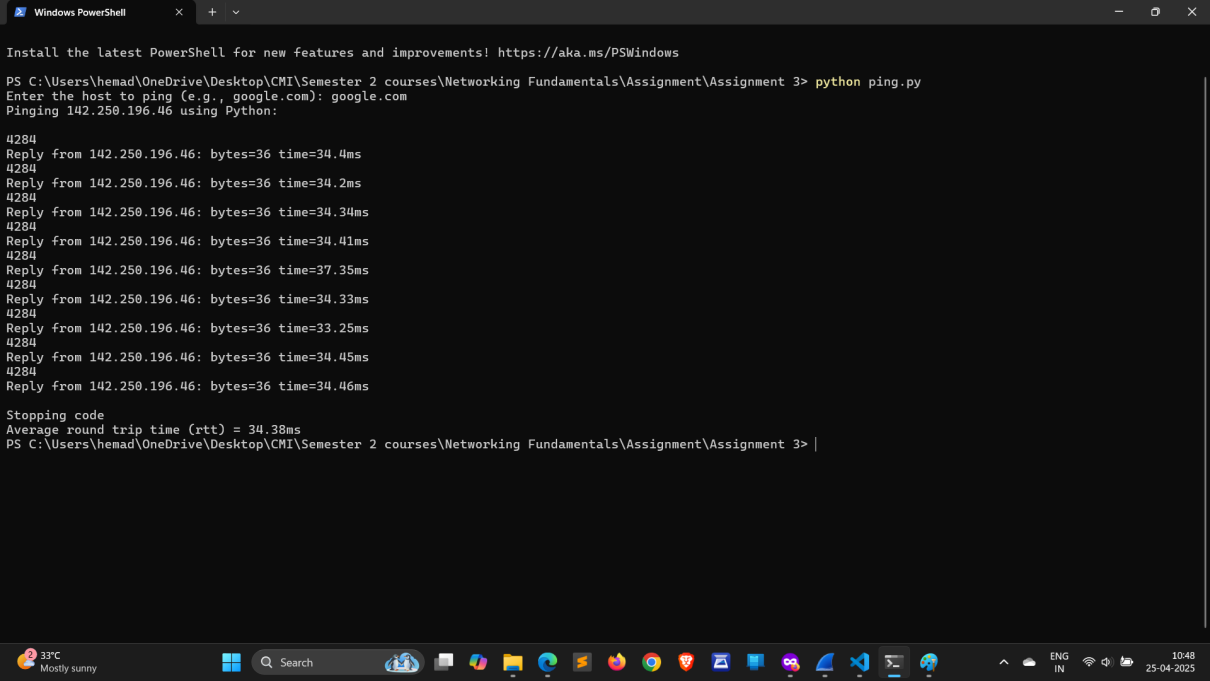
Heads-Up

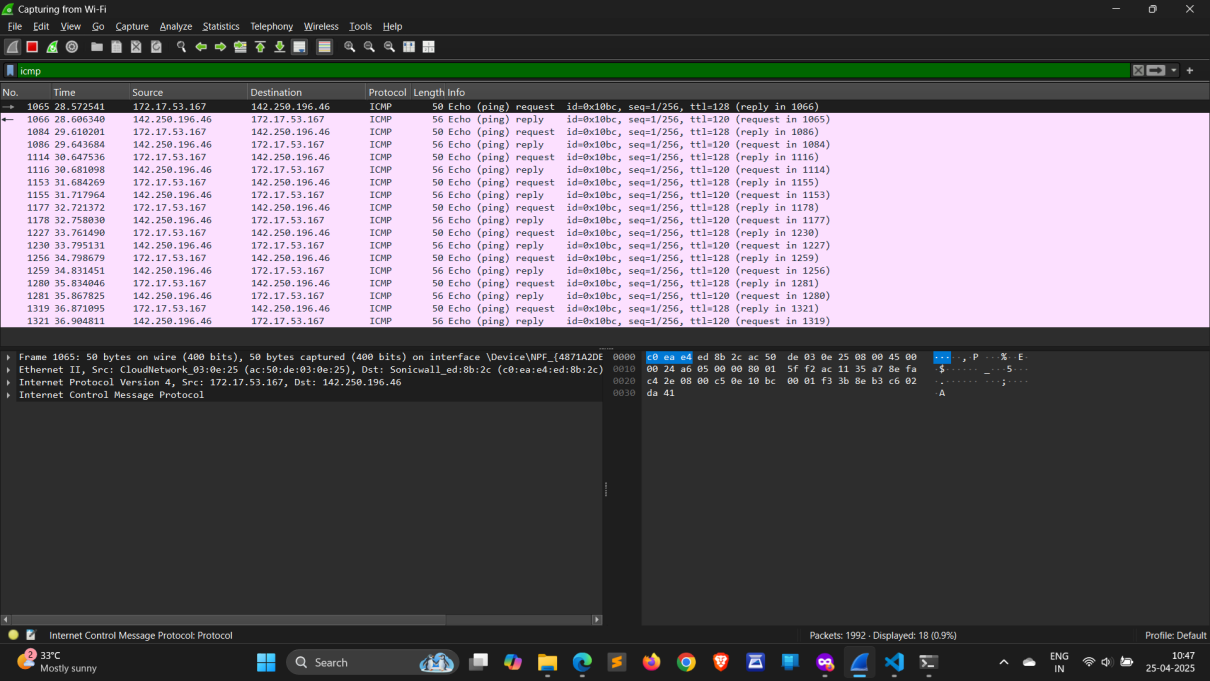
Since most of the code for this assignment was already given, we need to follow the used protocol.

We are using the **Extended Header** for **ID** and **Sequence**.

Ping

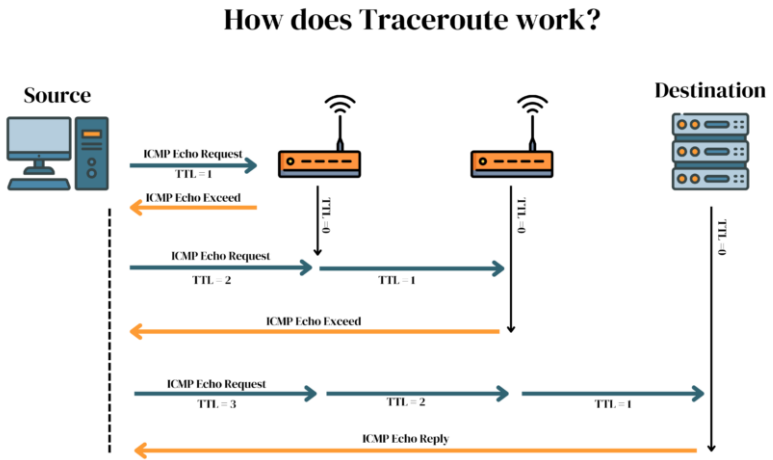
- **checksum(data)** : Calculates the checksum of the data
- **receiveOnePing(mySocket, ID, timeout, destAddr)** : To receive the echo reply
- **sendOnePing(mySocket, destAddr, ID)** : To send the echo request
- **doOnePing(destAddr, timeout)** : To call sendOnePing() and receiveOnePing()
- **ping(host, timeout=1)** : To call doOnePing() with the IP address of the host we want to ping with.


Windows PowerShell
Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows
PS C:\Users\hemad\OneDrive\Desktop\CMI\Semester 2 courses\Networking Fundamentals\Assignment\Assignment 3> python ping.py
Enter the host to ping (e.g., google.com): google.com
Pinging 142.250.196.46 using Python:
4284
Reply from 142.250.196.46: bytes=36 time=34.4ms
4284
Reply from 142.250.196.46: bytes=36 time=34.2ms
4284
Reply from 142.250.196.46: bytes=36 time=34.34ms
4284
Reply from 142.250.196.46: bytes=36 time=34.41ms
4284
Reply from 142.250.196.46: bytes=36 time=37.35ms
4284
Reply from 142.250.196.46: bytes=36 time=34.33ms
4284
Reply from 142.250.196.46: bytes=36 time=33.25ms
4284
Reply from 142.250.196.46: bytes=36 time=34.45ms
4284
Reply from 142.250.196.46: bytes=36 time=34.46ms
Stopping code
Average round trip time (rtt) = 34.38ms
PS C:\Users\hemad\OneDrive\Desktop\CMI\Semester 2 courses\Networking Fundamentals\Assignment\Assignment 3>
33°C
Mostly sunny
Search
ENG
IN
10:48
25-04-2025


Capturing from Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
icmp
No. Time Source Destination Protocol Length Info
1065 28.572541 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1066)
1066 28.606340 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1065)
1084 29.610201 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1086)
1086 29.643684 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1084)
1114 30.647536 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1116)
1116 30.681098 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1114)
1153 31.684269 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1155)
1155 31.717964 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1153)
1177 32.721372 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1178)
1178 32.758030 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1177)
1227 33.761490 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1230)
1230 33.795131 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1227)
1256 34.798679 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1259)
1259 34.831451 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1256)
1280 35.834046 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1281)
1281 35.867825 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1280)
1319 36.871095 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x10bc, seq=1/256, ttl=128 (reply in 1321)
1321 36.904811 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x10bc, seq=1/256, ttl=120 (request in 1319)
Frame 1065: 50 bytes on wire (400 bits), 50 bytes captured (400 bits) on interface \Device\NPF_{4871A2DE
Ethernet II, Src: CloudNetwork_03:0e:25 (ac:50:de:03:0e:25), Dst: Sonicwall_ed:8b:2c (c0:ea:e4:ed:8b:2c)
Internet Protocol Version 4, Src: 172.17.53.167, Dst: 142.250.196.46
Internet Control Message Protocol
0000 c0 ea e4 ed 8b 2c ac 50 de 03 0e 25 08 00 45 00
0010 00 24 a6 05 00 00 80 01 5f f2 ac 11 35 a7 8e fa
0020 c4 2e 08 00 c5 0e 10 bc 00 01 f3 3b 8e b3 c6 02
0030 da 41
Internet Control Message Protocol: Protocol
Packets: 1992 · Displayed: 18 (0.9%)
Profile: Default
33°C
Mostly sunny
Search
ENG
IN
10:47
25-04-2025

Traceroute

- It is used for checking the route from a computer to a hostname or an IP address.
- The **Traceroute** program sends packets with increasing TTL until we get reply from our target.



Traceroute

- **checksum(data)** : Calculates the checksum of the data
- **build_packet()** : To build the icmp packet
- **get_route(hostname)** : To send the icmp packets with increasing TTL and print the IP addresses of the routers it got the ICMP Time Exceeded Message (TEM) from.

Windows PowerShell

```
Windows PowerShell
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Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\hemad\OneDrive\Desktop\CMI\Semester 2 courses\Networking Fundamentals\Assignment\Assignment 3> python traceroute.py
Enter the host to ping (e.g., google.com): google.com
Traceroute to google.com [142.250.196.46], 30 hops max:
TTL=1, ICMP Type=11, From=123.63.203.209
TTL= 1    trie=0    ICMP Type=11    rtt=8.47 ms    123.63.203.209    Unknown


TTL=2, ICMP Type=11, From=182.19.106.103
TTL= 2    trie=0    ICMP Type=11    rtt=29.93 ms    182.19.106.103    Unknown


TTL=3, ICMP Type=11, From=123.63.158.87
TTL= 3    trie=0    ICMP Type=11    rtt=44.20 ms    123.63.158.87    Unknown


TTL=4, ICMP Type=11, From=123.63.158.92
TTL= 4    trie=0    ICMP Type=11    rtt=44.48 ms    123.63.158.92    Unknown


TTL=5, ICMP Type=11, From=74.125.48.70
TTL= 5    trie=0    ICMP Type=11    rtt=25.63 ms    74.125.48.70    Unknown


TTL=6, ICMP Type=11, From=142.251.76.31
TTL= 6    trie=0    ICMP Type=11    rtt=24.40 ms    142.251.76.31    Unknown


TTL=7, ICMP Type=11, From=192.178.110.248
TTL= 7    trie=0    ICMP Type=11    rtt=41.70 ms    192.178.110.248    Unknown


TTL=8, ICMP Type=11, From=216.239.48.64
TTL= 8    trie=0    ICMP Type=11    rtt=22.37 ms    216.239.48.64    Unknown


TTL=9, ICMP Type=11, From=142.250.56.39
TTL= 9    trie=0    ICMP Type=11    rtt=43.79 ms    142.250.56.39    Unknown


TTL=10, ICMP Type=11, From=142.250.208.153
TTL= 10    trie=0    ICMP Type=11    rtt=36.82 ms    142.250.208.153    Unknown


TTL=11, ICMP Type=11, From=142.251.55.31
TTL= 11    trie=0    ICMP Type=11    rtt=33.80 ms    142.251.55.31    Unknown


TTL=12, ICMP Type=0, From=142.250.196.46
TTL= 12    trie=0    ICMP Type=0    rtt=34.33 ms    142.250.196.46    maa03s45-in-f14.1e100.net
```

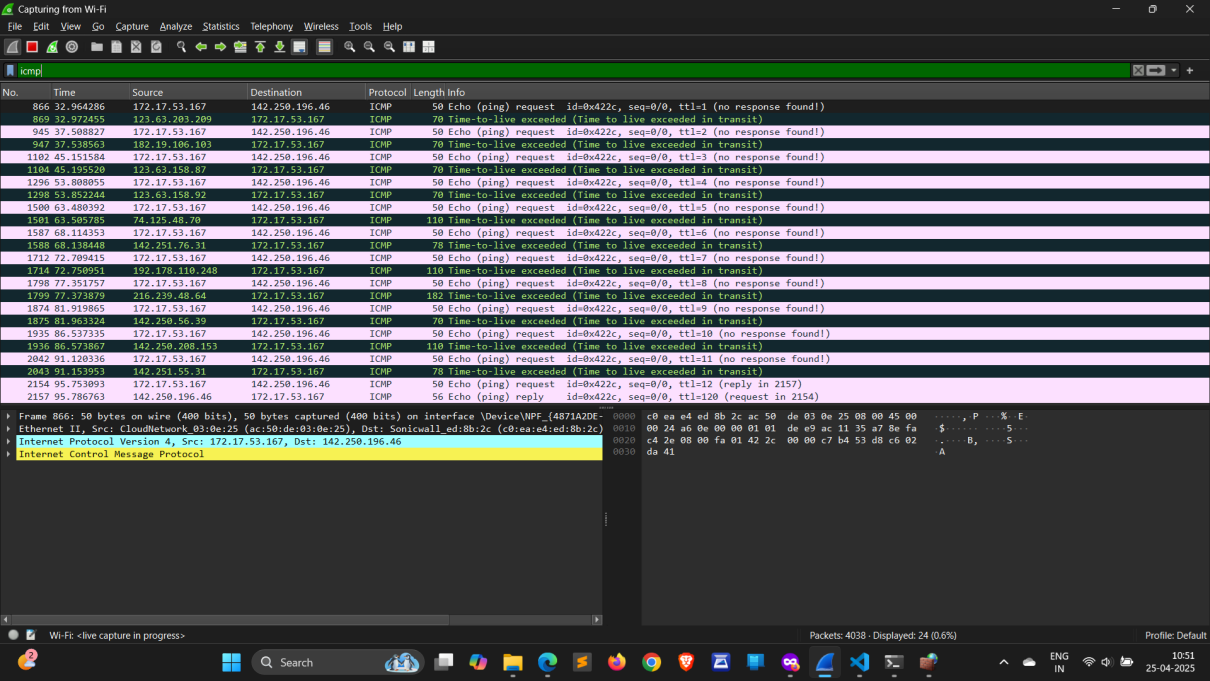
Capturing from Wi-Fi
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
icmp
No. Time Source Destination Protocol Length Info
866 32.964286 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=1 (no response found!)
869 32.972455 123.63.203.209 172.17.53.167 ICMP 70 Time-to-live exceeded (Time to live exceeded in transit)
945 37.508827 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=2 (no response found!)
947 37.538563 182.19.106.103 172.17.53.167 ICMP 70 Time-to-live exceeded (Time to live exceeded in transit)
1102 45.151584 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=3 (no response found!)
1104 45.195520 123.63.158.87 172.17.53.167 ICMP 70 Time-to-live exceeded (Time to live exceeded in transit)
1296 53.808055 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=4 (no response found!)
1298 53.852264 123.63.158.92 172.17.53.167 ICMP 70 Time-to-live exceeded (Time to live exceeded in transit)
1500 63.480392 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=5 (no response found!)
1501 63.505785 74.125.48.70 172.17.53.167 ICMP 110 Time-to-live exceeded (Time to live exceeded in transit)
1587 68.114353 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=6 (no response found!)
1588 68.138448 142.251.76.31 172.17.53.167 ICMP 78 Time-to-live exceeded (Time to live exceeded in transit)
1712 72.709415 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=7 (no response found!)
1714 72.750951 192.178.110.248 172.17.53.167 ICMP 110 Time-to-live exceeded (Time to live exceeded in transit)
1798 77.351757 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=8 (no response found!)
1799 77.373879 216.239.48.64 172.17.53.167 ICMP 182 Time-to-live exceeded (Time to live exceeded in transit)
1874 81.919865 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=9 (no response found!)
1875 81.963324 142.250.56.39 172.17.53.167 ICMP 70 Time-to-live exceeded (Time to live exceeded in transit)
1935 86.537335 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=10 (no response found!)
1936 86.573867 142.250.208.153 172.17.53.167 ICMP 110 Time-to-live exceeded (Time to live exceeded in transit)
2042 91.120336 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=11 (no response found!)
2043 91.153953 142.251.55.31 172.17.53.167 ICMP 78 Time-to-live exceeded (Time to live exceeded in transit)
2154 95.753093 172.17.53.167 142.250.196.46 ICMP 50 Echo (ping) request id=0x422c, seq=0/0, ttl=12 (reply in 2157)
2157 95.786763 142.250.196.46 172.17.53.167 ICMP 56 Echo (ping) reply id=0x422c, seq=0/0, ttl=120 (request in 2154)
Frame 866: 50 bytes on wire (400 bits), 50 bytes captured (400 bits) on interface \Device\NPF_{4871A2DE-
Ethernet II, Src: CloudNetwork_03:0e:25 (ac:50:de:03:0e:25), Dst: Sonicwall_ed:8b:2c (c0:ea:e4:ed:8b:2c)
Internet Protocol Version 4, Src: 172.17.53.167, Dst: 142.250.196.46
Internet Control Message Protocol
0000 c0 ea e4 ed 8b 2c ac 50 de 03 0e 25 08 00 45 00 .....,.P ...%..E.
0010 00 24 a6 0e 00 00 01 01 de e9 ac 11 35 a7 8e fa .$...... ....5...
0020 c4 2e 08 00 fa 01 42 2c 00 00 c7 b4 53 d8 c6 02 ......B, ...S...
0030 da 41 .A
Wi-Fi: <live capture in progress>
Packets: 4038 · Displayed: 24 (0.6%)
Profile: Default
Search
ENG IN
10:51 25-04-2025

The End