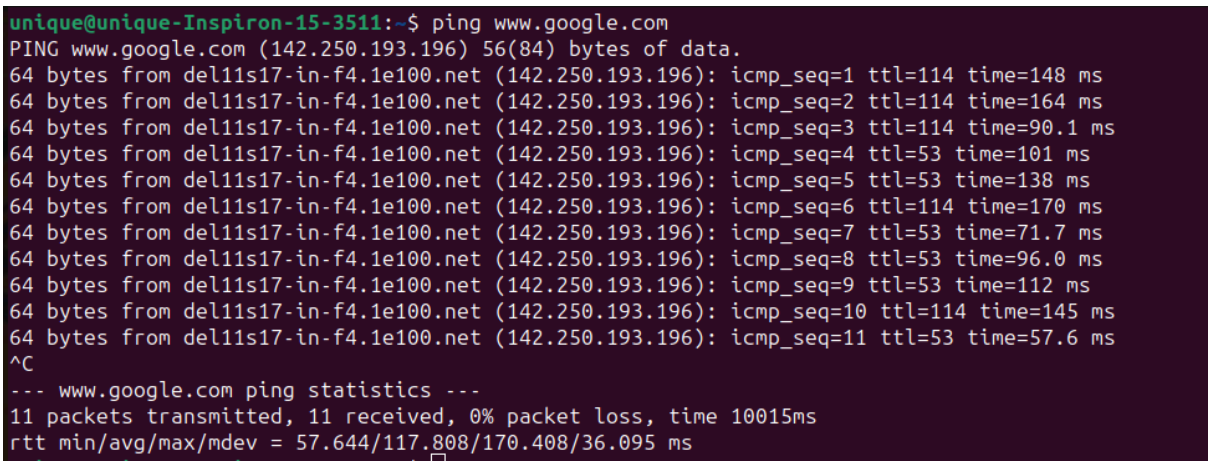

Figure 1.1: Using Ping for a website

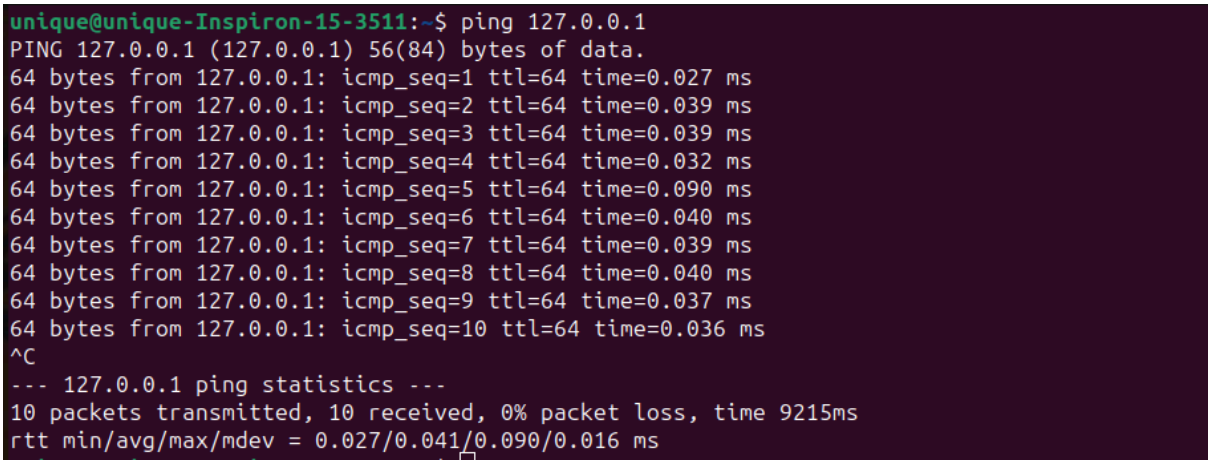

Figure 1.2 : Using ping for localhost i.e 127.0.0.1

Ping Utility :

1) **Purpose** :

- It's used to check that stability and status of the Internet Connection .
- Similar to a radar , it's broadcasts , signals and based the returning response , it generates the information
- It consistently generates signals for a while to check consistency

The examples are given in Fig 1.1 and Fig 1.2

2) **Ping Output Analysis** :

- Hostname/IP Address**:**
    - Output begins with the IP address of the target . (resolved to IP address if hostname was given)
- ICMP Sequence Number**:**
    - Each line, includes a sequence number (`icmp_seq=#`) which indicates the order of the ping requests sent.
- TTL (Time to Live)**:**
    - The TTL value in the response (`ttl=X`) indicates how many hops the packet can pass through before being discarded. A lower TTL value in the reply suggests that the packet passed through more network hops.
    - TTL -> literally , the time to live , before it reaches a router , so , lesser TTL implies more hops (hops on routers)
- Round-Trip Time (RTT)**:**
    - The RTT is shown in milliseconds (`time=X ms`). It represents the time taken for a packet to travel from the source to the destination and back. Lower RTT values indicate faster network performance.
- Packet Loss**:**
    - After the pings complete, a summary indicates the percentage of packet loss. Ideally, this should be 0%, meaning all sent packets received a reply.

Statistics Summary**:**

- Packets Transmitted/Received**:** The number of packets sent and the number of replies received.
- Packet Loss: Shows how many packets were lost as a percentage.
- RTT Statistics**:** Includes the minimum, maximum, average, and sometimes standard deviation of the RTTs.

3) **The options available in ping** :

```
unique@unique-Inspiron-15-3511:~$ ping -c 4 www.google.com
PING www.google.com (142.250.77.228) 56(84) bytes of data.
64 bytes from del11s09-in-f4.1e100.net (142.250.77.228): icmp_seq=1 ttl=52 time=110 ms
64 bytes from del11s09-in-f4.1e100.net (142.250.77.228): icmp_seq=2 ttl=114 time=110 ms
64 bytes from del11s09-in-f4.1e100.net (142.250.77.228): icmp_seq=3 ttl=114 time=146 ms
64 bytes from del11s09-in-f4.1e100.net (142.250.77.228): icmp_seq=4 ttl=52 time=152 ms

--- www.google.com ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3004ms
rtt min/avg/max/mdev = 109.544/129.465/152.291/19.702 ms
unique@unique-Inspiron-15-3511:~$
```

- The - -c count option : sends requests count number of times
- Ping -c #num <destination> {syntax}

```
unique@unique-Inspiron-15-3511:~$ ping -s 100 www.google.com
PING www.google.com (142.250.195.4) 100(128) bytes of data.
76 bytes from del12s09-in-f4.1e100.net (142.250.195.4): icmp_seq=1 ttl=114 (truncated)
76 bytes from del12s09-in-f4.1e100.net (142.250.195.4): icmp_seq=2 ttl=52 (truncated)
76 bytes from del12s09-in-f4.1e100.net (142.250.195.4): icmp_seq=3 ttl=114 (truncated)
76 bytes from del12s09-in-f4.1e100.net (142.250.195.4): icmp_seq=4 ttl=52 (truncated)
76 bytes from del12s09-in-f4.1e100.net (142.250.195.4): icmp_seq=5 ttl=114 (truncated)
76 bytes from del12s09-in-f4.1e100.net (142.250.195.4): icmp_seq=6 ttl=52 (truncated)
76 bytes from del12s09-in-f4.1e100.net (142.250.195.4): icmp_seq=7 ttl=114 (truncated)
^C
--- www.google.com ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6009ms
rtt min/avg/max/mdev = 109.989/154.246/188.417/24.079 ms
unique@unique-Inspiron-15-3511:~$
```

- The -s (size) options decides the size of the echo message sent to the target
- Ping -s #size <destination> {syntax}

```
unique@unique-Inspiron-15-3511:~$ ping -t 5 www.google.com
PING www.google.com (142.250.206.164) 56(84) bytes of data.
From 10.118.248.49 (10.118.248.49) icmp_seq=1 Time to live exceeded
From ws197-251-252-122.rcil.gov.in (122.252.251.197) icmp_seq=2 Time to live exceeded
From 10.118.248.49 (10.118.248.49) icmp_seq=3 Time to live exceeded
From ws197-251-252-122.rcil.gov.in (122.252.251.197) icmp_seq=4 Time to live exceeded
From 10.118.248.49 (10.118.248.49) icmp_seq=5 Time to live exceeded
From 10.118.248.49 (10.118.248.49) icmp_seq=6 Time to live exceeded
From 10.118.248.49 (10.118.248.49) icmp_seq=7 Time to live exceeded
^C
--- www.google.com ping statistics ---
7 packets transmitted, 0 received, +7 errors, 100% packet loss, time 6003ms

unique@unique-Inspiron-15-3511:~$ ping -t 100 www.google.com
PING www.google.com (142.250.206.164) 56(84) bytes of data.
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=1 ttl=52 time=104 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=2 ttl=56 time=126 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=3 ttl=56 time=153 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=4 ttl=52 time=61.3 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=5 ttl=52 time=185 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=6 ttl=52 time=227 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=7 ttl=52 time=123 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=8 ttl=56 time=159 ms
^C
--- www.google.com ping statistics ---
8 packets transmitted, 8 received, 0% packet loss, time 7008ms
rtt min/avg/max/mdev = 61.329/142.204/226.703/47.460 ms
```

- The -ttl option decides the TTL (time to live) , if it exceeds given , it’s an error !

```
unique@unique-Inspiron-15-3511:~$ ping -w 3 www.google.com
PING www.google.com (142.250.206.164) 56(84) bytes of data.
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=1 ttl=56 time=191 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=2 ttl=52 time=231 ms
64 bytes from del11s22-in-f4.1e100.net (142.250.206.164): icmp_seq=3 ttl=56 time=103 ms

--- www.google.com ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 103.064/174.884/230.839/53.356 ms
```

- The -w option decides the time limit of how long will a ping command persist

4) **Using Ping for Network Troubleshooting :**

Step 1: Basic Connectivity Check

- Command: `ping server.example.com`
- Purpose: Start with a basic `ping` to check if the server is reachable and if ICMP packets are being returned. This helps to confirm whether the server is online and responding.
  Expected Outcome: If the server responds with no packet loss and low latency, basic connectivity is fine. If there's packet loss or high latency, it indicates an issue.

Step 2: Checking for Packet Loss Over Time

- Command: `ping -c 100 server.example.com`
- Purpose: By pinging the server 100 times, you can observe any intermittent packet loss. This is useful to determine if the problem is sporadic.
  Expected Outcome: The summary at the end will show the percentage of packet loss. Even a small amount of packet loss could indicate network issues.

Step 3: Diagnosing High Latency or Jitter

- Command: `ping -i 0.2 -c 50 server.example.com`
- Purpose: Set the interval between pings to 0.2 seconds to send pings more frequently. This can help detect if there are fluctuations in latency, which might suggest network jitter or congestion.
  Expected Outcome: Consistent RTT values are good, but significant variance in RTT could indicate jitter, which can degrade the performance of real-time applications like VoIP.

Step 4: Testing Larger Packets for MTU Issues

- Command: `ping -s 1472 server.example.com`
- Purpose: Use the `-s` option to send larger packets (1472 bytes is the largest payload that, combined with ICMP headers, fits into the default MTU of 1500 bytes). This checks if there are issues with packet fragmentation or MTU settings along the path.

Expected Outcome: If larger packets are consistently lost or delayed, it might indicate an MTU mismatch or a problem with packet fragmentation.

Step 5: Checking Routing with TTL

- Command: `ping -t 5 server.example.com`
- Purpose: Set a low TTL value to see if the packet reaches a certain number of hops before being discarded. This can help determine if a specific router or hop is causing the issue.
  Expected Outcome: If the packet fails at a certain hop consistently, it might point to issues with that particular network segment or router.

Step 6: Setting a Timeout for Quick Diagnostics

- Command: `ping -W 10 server.example.com`
- Purpose: Use the `-W` option to ping the server with a 10-second deadline. This is useful if you want to quickly test connectivity within a specific timeframe.
  Expected Outcome: If the server doesn't respond within 10 seconds, the connection might be slow or the server might be overloaded