Lab Assignment 2

AIM: Study of basic network command and Network configuration commands.

1. **Ping**

   Purpose: Tests connectivity between your computer and a remote host. It sends ICMP Echo Request messages to the target host and measures the time it takes to receive a response, helping you determine if the host is reachable and the round-trip time of packets.

   Example: ping iitram.ac.in

   Output: This command sends packets to `google.com` and waits for replies. You will see the IP address of the target and the time it took for each packet to travel to the destination and back.

```
C:\Users\trang>ping iitram.ac.in

Pinging iitram.ac.in [64:ff9b::c74f:3e5d] with 32 bytes of data:
Reply from 64:ff9b::c74f:3e5d: time=312ms
Reply from 64:ff9b::c74f:3e5d: time=442ms
Reply from 64:ff9b::c74f:3e5d: time=561ms
Reply from 64:ff9b::c74f:3e5d: time=575ms

Ping statistics for 64:ff9b::c74f:3e5d:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 312ms, Maximum = 575ms, Average = 472ms
```

   Output:

   - The host 199.79.62.93 (iitram server) is reachable.
   - Packets: Sent = 4, Received = 4, Lost = 0 (0% loss) → confirms reliable connectivity. Round Trip Times: Minimum = 312ms, Maximum = 575ms, Average = 472ms → indicates network latency.

2. **Traceroute (tracert on Windows)**

Purpose: Tracert is a command which can show you the path a packet of information taken from your computer to one you specify. It will list all the routers it passes through until it reaches its destination, or fails to and is discarded. In addition to this, it will tell you how long each 'hop' from router to router takes.

Usage: tracert [hostname/IP address]

Example: traceroute iitram.ac.in or tracert iitram.ac.in

Output: Lists each hop along the route and the time taken

```
C:\Users\trang>tracert iitram.ac.in

Tracing route to iitram.ac.in [64:ff9b::c74f:3e5d]
over a maximum of 30 hops:

  1    13 ms     3 ms     2 ms  2409:40c1:0:fa5a::33
  2    99 ms    95 ms   106 ms  2405:200:5210:0:3924:0:3:3
  3   235 ms    56 ms   132 ms  2405:200:5210:0:3925::ff06
  4    21 ms   114 ms    27 ms  2405:200:809:3632:61::6
  5    24 ms    84 ms   199 ms  64:ff9b::c0a8:e3c2
  6   112 ms    18 ms    19 ms  64:ff9b::c0a8:bc30
  7     *        *        *     Request timed out.
  8     *        *        *     Request timed out.
  9    88 ms   102 ms    98 ms  64:ff9b::67c6:8cb0
 10   316 ms   211 ms   193 ms  64:ff9b::67c6:8cd7
 11   307 ms   285 ms   307 ms  64:ff9b::67c6:8cd7
 12   320 ms   305 ms   409 ms  hu0-0-0-9.ccr31.mrs02.atlas.cogentco.com [64:ff9b::950e:7d01]
 13   198 ms   305 ms   202 ms  mei-b5-link.ip.twelve99.net [64:ff9b::3e73:b8c]
 14   406 ms   204 ms   202 ms  prs-bb1-link.ip.twelve99.net [64:ff9b::3e73:7c36]
 15     *        *        *     Request timed out.
 16   502 ms   305 ms   305 ms  atl-bb1-link.ip.twelve99.net [64:ff9b::3e73:8a47]
 17   411 ms   325 ms   387 ms  atl-b4-link.ip.twelve99.net [64:ff9b::3e73:86e1]
 18   497 ms   408 ms   307 ms  newfolddigital-ic-381439.ip.twelve99-cust.net [64:ff9b::3e73:b58d]
 19   395 ms   406 ms   305 ms  xe-2-0-0.rtrn1.dal1.net.unifiedlayer.com [64:ff9b::a2d7:f303]
 20   503 ms   306 ms   406 ms  gr0-0-0-u1.prv-vx-rtr1.net.endurance.com [64:ff9b::a2d7:f3e5]
 21   479 ms   509 ms   612 ms  69-195-64-235.unifiedlayer.com [64:ff9b::45c3:40eb]
 22   416 ms   509 ms   509 ms  69-195-64-113.unifiedlayer.com [64:ff9b::45c3:4071]
 23   411 ms   310 ms   318 ms  162-144-240-177.unifiedlayer.com [64:ff9b::a290:f0b1]
 24   487 ms   321 ms   300 ms  cp-32.webhostbox.net [64:ff9b::c74f:3e5d]

Trace complete.
```

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3. i**pconfig (Windows) / ifconfig (Linux/Mac) / ip (Linux)**

   Purpose: Displays and manages IP configuration.

   Usage:

   ipconfig (Windows)

   Example: ipconfig or ifconfig or ip addr

   Output: Shows IP address, subnet mask, gateway, and other network interface details.

```
C:\Users\trang>ipconfig

Windows IP Configuration


Ethernet adapter Ethernet 3:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::3d7d:cfbb:3850:da1a%6
   IPv4 Address. . . . . . . . . . . : 192.168.56.1
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :

Wireless LAN adapter Local Area Connection* 1:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Local Area Connection* 2:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :

Wireless LAN adapter Wi-Fi:

   Connection-specific DNS Suffix  . :
   IPv6 Address. . . . . . . . . . . : 2409:40c1:0:fa5a:bb4:46d5:4fe:ae57
   Temporary IPv6 Address. . . . . . : 2409:40c1:0:fa5a:d161:e1db:50e7:262b
   Link-local IPv6 Address . . . . . : fe80::ff73:1447:d14b:488d%14
   IPv4 Address. . . . . . . . . . . : 10.63.194.233
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . : fe80::3cef:4dff:fe29:ccab%14
                                       10.63.194.206

Ethernet adapter Bluetooth Network Connection:

   Media State . . . . . . . . . . . : Media disconnected
   Connection-specific DNS Suffix  . :
```

4. **netstat**

Purpose: Displays network connections, routing tables, and interface statistics.

Usage: netstat [options]

Example: netstat -a (shows all connections and listening ports)

Output: Lists active connections, listening ports, and network statistics.

```
C:\Users\trang>netstat

Active Connections

  Proto  Local Address          Foreign Address        State
  TCP    10.63.194.233:63064    10.63.194.206:domain   TIME_WAIT
  TCP    127.0.0.1:49670        kubernetes:49671       ESTABLISHED
  TCP    127.0.0.1:49671        kubernetes:49670       ESTABLISHED
  TCP    127.0.0.1:49672        kubernetes:49673       ESTABLISHED
  TCP    127.0.0.1:49673        kubernetes:49672       ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:49423  [2603:1040:a06:6::1]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:56529  [2603:1046:c04:1400::2]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:56530  [2603:1046:c04:818::2]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:56969  tzdelb-ao-in-x0e:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:56999  [2603:1046:c04:140d::2]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57000  whatsapp-chatd-edge6-shv-02-pnq1:http  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57001  [64:ff9b::142a:491e]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57002  [2405:200:1630:b2c:face:b00c:3333:7020]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57003  [2405:200:1609:1817:face:b00c:3333:7020]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57004  [2405:200:1630:ff80:face:b00c:3333:7020]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57005  whatsapp-cdn6-shv-01-pnq1:https  CLOSE_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57006  [2405:200:163d:1703:face:b00c:3333:7020]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57007  whatsapp-cdn6-shv-01-bom1:https  CLOSE_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57008  whatsapp-cdn6-shv-02-bom2:https  CLOSE_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57009  [2405:200:1609:2885:face:b00c:3333:7020]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57010  [64:ff9b::68d0:1059]:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57011  [64:ff9b::142a:491f]:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57013  [2a01:111:f402:f0dc::53]:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57014  [2603:1046:1404:1::18]:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57015  [2603:1046:1404:1::18]:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57017  [64:ff9b::330b:a8e8]:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:57621  sf-in-f188:5228        ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:58598  [2603:1046:1400:1::2]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:60833  bom12s18-in-x0a:https  TIME_WAIT
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:60925  [2606:4700:8d71:d8b7:9ad7:51e:ccf5:ac50]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63065  [2620:1ec:8fa::10]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63066  [2603:1046:1404:1::18]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63067  [2a01:111:f402:f0dc::53]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63068  [2603:1046:1404:1::18]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63069  [64:ff9b::142a:491a]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63070  [64:ff9b::68d0:1059]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63071  [64:ff9b::34a8:75a8]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63072  [64:ff9b::34a8:75a8]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63909  [2603:1040:a06:6::]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63975  [2603:1026:c12:a::2]:https  ESTABLISHED
  TCP    [2409:40c1:0:fa5a:d161:e1db:50e7:262b]:63979  [2603:1046:c04:140d::2]:https  ESTABLISHED
```

5. route

Purpose: Shows or modifies the IP routing table.

Usage: route [command] [options]

Example: route print

Output: Displays the current routing table or allows modification of routes.

```
C:\Users\trang>route print
===========================================================================
Interface List
  6...0a 00 27 00 00 06 ......VirtualBox Host-Only Ethernet Adapter
 16...fa 54 f6 a1 5f a7 ......Microsoft Wi-Fi Direct Virtual Adapter
 22...fe 54 f6 a1 5f a7 ......Microsoft Wi-Fi Direct Virtual Adapter #2
 14...f8 54 f6 a1 5f a7 ......Realtek RTL8822CE 802.11ac PCIe Adapter
  7...f8 54 f6 a1 5f a6 ......Bluetooth Device (Personal Area Network)
  1...........................Software Loopback Interface 1
===========================================================================

IPv4 Route Table
===========================================================================
Active Routes:
Network Destination        Netmask          Gateway       Interface  Metric
          0.0.0.0          0.0.0.0    10.63.194.206    10.63.194.233     55
       10.63.194.0    255.255.255.0         On-link     10.63.194.233    311
    10.63.194.233  255.255.255.255         On-link     10.63.194.233    311
    10.63.194.255  255.255.255.255         On-link     10.63.194.233    311
        127.0.0.0        255.0.0.0         On-link         127.0.0.1    331
        127.0.0.1  255.255.255.255         On-link         127.0.0.1    331
  127.255.255.255  255.255.255.255         On-link         127.0.0.1    331
     192.168.56.0    255.255.255.0         On-link      192.168.56.1    281
     192.168.56.1  255.255.255.255         On-link      192.168.56.1    281
   192.168.56.255  255.255.255.255         On-link      192.168.56.1    281
        224.0.0.0        240.0.0.0         On-link         127.0.0.1    331
        224.0.0.0        240.0.0.0         On-link      192.168.56.1    281
        224.0.0.0        240.0.0.0         On-link     10.63.194.233    311
  255.255.255.255  255.255.255.255         On-link         127.0.0.1    331
  255.255.255.255  255.255.255.255         On-link      192.168.56.1    281
  255.255.255.255  255.255.255.255         On-link     10.63.194.233    311
===========================================================================
Persistent Routes:
  None

IPv6 Route Table
===========================================================================
Active Routes:
 If Metric Network Destination      Gateway
 14     71 ::/0                     fe80::3cef:4dff:fe29:ccab
  1    331 ::1/128                  On-link
 14     71 2409:40c1:0:fa5a::/64    On-link
 14    311 2409:40c1:0:fa5a:bb4:46d5:4fe:ae57/128
                                    On-link
 14    311 2409:40c1:0:fa5a:d161:e1db:50e7:262b/128
                                    On-link
  6    281 fe80::/64                On-link
 14    311 fe80::/64                On-link
  6    281 fe80::3d7d:cfbb:3850:da1a/128
                                    On-link
 14    311 fe80::ff73:1447:d14b:488d/128
                                    On-link
  1    331 ff00::/8                 On-link
  6    281 ff00::/8                 On-link
 14    311 ff00::/8                 On-link
===========================================================================
Persistent Routes:
  None
```

6. **nslookup**

Purpose: Queries the DNS to obtain domain name or IP address mapping.

Usage: nslookup [hostname] or nslookup [IP address]

Example: nslookup iitram.ac.in

Output: Shows DNS server information and the resolved IP address or domain name.

```
C:\Users\trang>nslookup iitram.ac.in
Server:  UnKnown
Address:  10.63.194.206

Non-authoritative answer:
Name:    iitram.ac.in
Addresses:  64:ff9b::c74f:3e5d
          199.79.62.93
```

7. **Arp**

Purpose: Displays and manages the ARP cache (IP-to-MAC mappings).

Usage: arp -a

Output: Lists IP addresses and their corresponding MAC addresses.

```
C:\Users\trang>arp -a

Interface: 192.168.56.1 --- 0x6
  Internet Address      Physical Address      Type
  192.168.56.255        ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.102.18        01-00-5e-7f-66-12     static
  239.255.255.250       01-00-5e-7f-ff-fa     static

Interface: 10.63.194.233 --- 0xe
  Internet Address      Physical Address      Type
  10.63.194.206         3e-ef-4d-29-cc-ab     dynamic
  10.63.194.255         ff-ff-ff-ff-ff-ff     static
  224.0.0.22            01-00-5e-00-00-16     static
  224.0.0.251           01-00-5e-00-00-fb     static
  224.0.0.252           01-00-5e-00-00-fc     static
  239.255.102.18        01-00-5e-7f-66-12     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
  255.255.255.255       ff-ff-ff-ff-ff-ff     static
```

8. **mtr** (Linux)

Purpose: A continuous traceroute tool that provides real-time stats of each hop.

Usage: mtr [hostname/IP]

Example: mtr iitram.ac.in

Output: Live table showing latency, packet loss, and hops.

9. **nmcli (Linux)**

Purpose: Command-line tool for NetworkManager (configure interfaces, Wi-Fi, etc.).

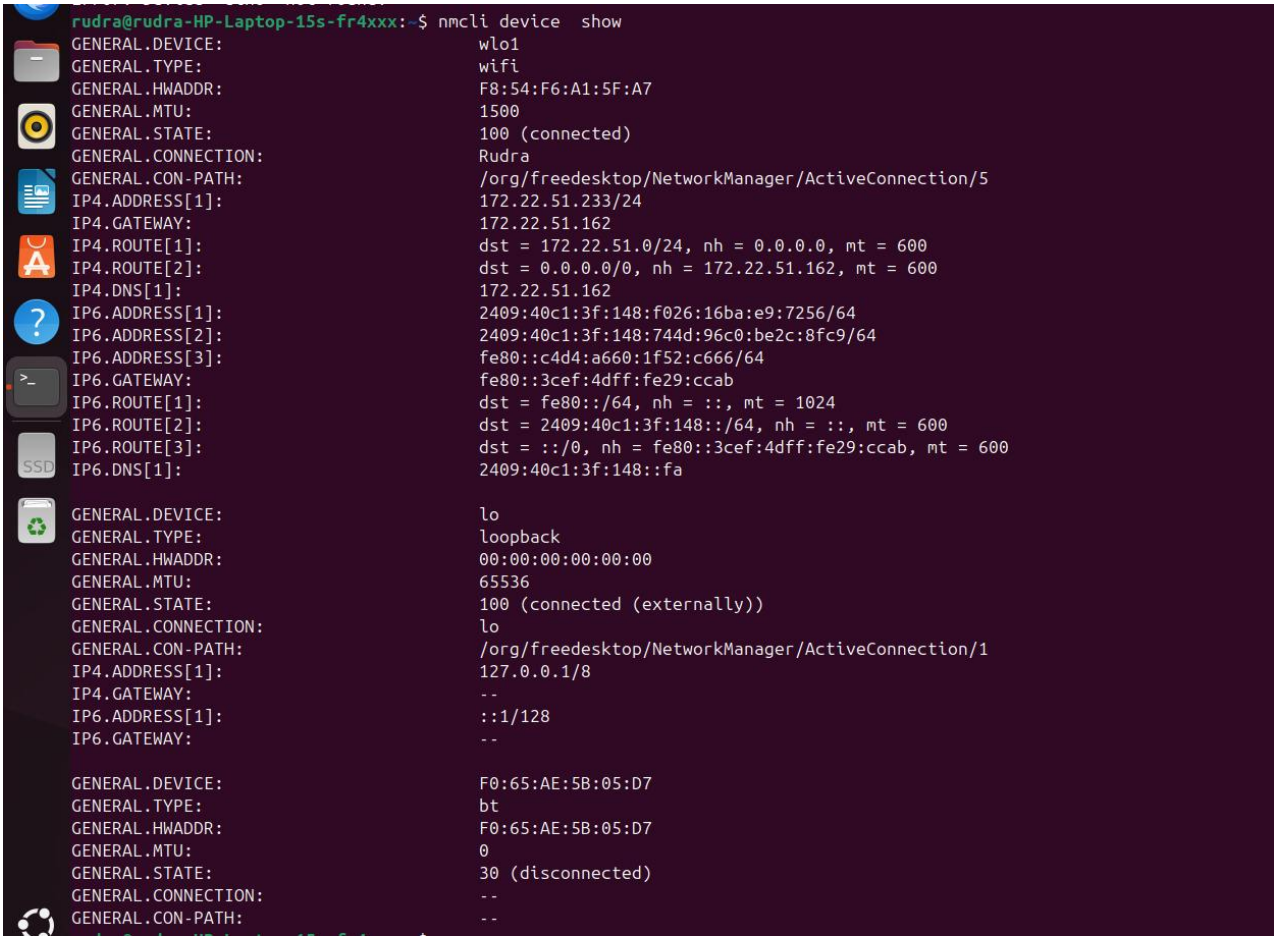
Usage:

nmcli device status

nmcli connection show

Example: nmcli device show

Output: Detailed interface information (IP, DNS, status).



10. tcpdump (Linux)

Purpose: Captures and analyzes network traffic on an interface. It is widely used for troubleshooting, monitoring, and packet-level analysis.

Usage: `tcpdump` [options]

Examples:

Capture all packets on an interface:

tcpdump -i eth0

Capture only TCP packets on port 80 (HTTP):

tcpdump -i eth0 tcp port 80

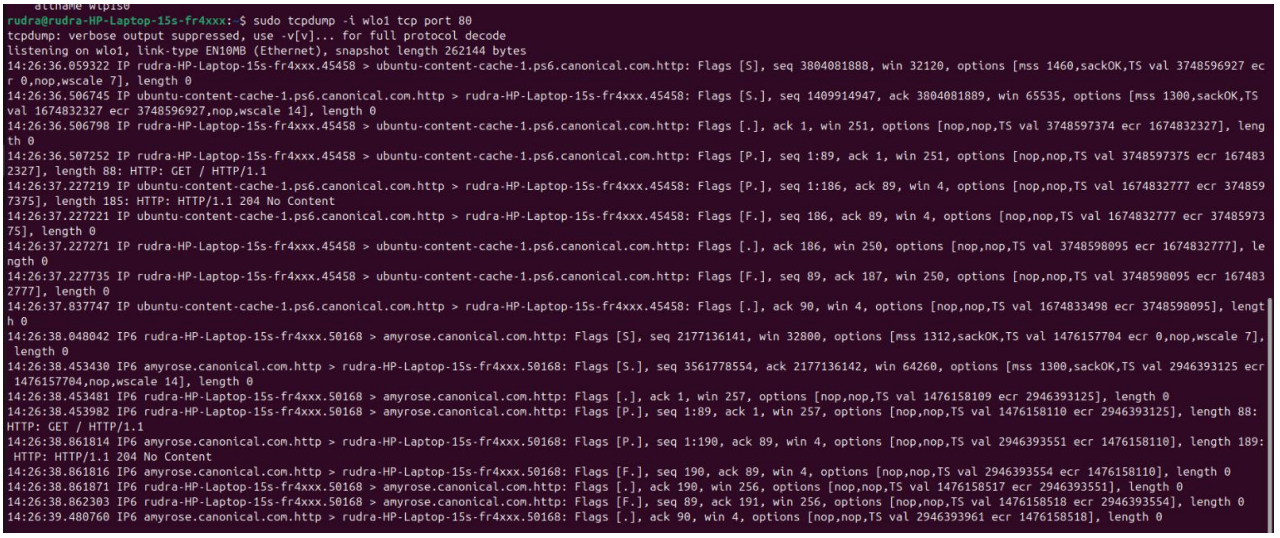
Save captured packets to a file:

tcpdump -i eth0 -w capture.pcap

Read packets from a file:

tcpdump -r capture.pcap

Output: Displays real-time packet information, such as source/destination IP, port, protocol, flags, and packet length.


rudra@rudra-HP-Laptop-15s-fr4xxx: $ sudo tcpdump -i wlo1 tcp port 80
tcpdump: verbose output suppressed, use -v[v]... for full protocol decode
listening on wlo1, link-type EN10MB (Ethernet), snapshot length 262144 bytes
14:26:36.059322 IP rudra-HP-Laptop-15s-fr4xxx.45458 > ubuntu-content-cache-1.ps6.canonical.com.http: Flags [S], seq 3804081888, win 32120, options [mss 1460,sackOK,TS val 3748596927 ecr 0,nop,wscale 7], length 0
14:26:36.506745 IP ubuntu-content-cache-1.ps6.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.45458: Flags [S.], seq 1409914947, ack 3804081889, win 65535, options [mss 1300,sackOK,TS val 1674832327 ecr 3748596927,nop,wscale 14], length 0
14:26:36.506798 IP rudra-HP-Laptop-15s-fr4xxx.45458 > ubuntu-content-cache-1.ps6.canonical.com.http: Flags [.], ack 1, win 251, options [nop,nop,TS val 3748597374 ecr 1674832327], length 0
14:26:36.507252 IP rudra-HP-Laptop-15s-fr4xxx.45458 > ubuntu-content-cache-1.ps6.canonical.com.http: Flags [P.], seq 1:89, ack 1, win 251, options [nop,nop,TS val 3748597375 ecr 1674832327], length 88: HTTP: GET / HTTP/1.1
14:26:37.227219 IP ubuntu-content-cache-1.ps6.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.45458: Flags [P.], seq 1:186, ack 89, win 4, options [nop,nop,TS val 1674832777 ecr 3748597375], length 185: HTTP: HTTP/1.1 204 No Content
14:26:37.227221 IP ubuntu-content-cache-1.ps6.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.45458: Flags [F.], seq 186, ack 89, win 4, options [nop,nop,TS val 1674832777 ecr 3748597375], length 0
14:26:37.227271 IP rudra-HP-Laptop-15s-fr4xxx.45458 > ubuntu-content-cache-1.ps6.canonical.com.http: Flags [.], ack 186, win 250, options [nop,nop,TS val 3748598095 ecr 1674832777], length 0
14:26:37.227735 IP rudra-HP-Laptop-15s-fr4xxx.45458 > ubuntu-content-cache-1.ps6.canonical.com.http: Flags [F.], seq 89, ack 187, win 250, options [nop,nop,TS val 3748598095 ecr 1674832777], length 0
14:26:37.837747 IP ubuntu-content-cache-1.ps6.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.45458: Flags [.], ack 90, win 4, options [nop,nop,TS val 1674833498 ecr 3748598095], length 0
14:26:38.048042 IP6 rudra-HP-Laptop-15s-fr4xxx.50168 > amyrose.canonical.com.http: Flags [S], seq 2177136141, win 32800, options [mss 1312,sackOK,TS val 1476157704 ecr 0,nop,wscale 7], length 0
14:26:38.453430 IP6 amyrose.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.50168: Flags [S.], seq 3561778554, ack 2177136142, win 64260, options [mss 1300,sackOK,TS val 2946393125 ecr 1476157704,nop,wscale 14], length 0
14:26:38.453481 IP6 rudra-HP-Laptop-15s-fr4xxx.50168 > amyrose.canonical.com.http: Flags [.], ack 1, win 257, options [nop,nop,TS val 1476158109 ecr 2946393125], length 0
14:26:38.453982 IP6 rudra-HP-Laptop-15s-fr4xxx.50168 > amyrose.canonical.com.http: Flags [P.], seq 1:89, ack 1, win 257, options [nop,nop,TS val 1476158110 ecr 2946393125], length 88: HTTP: GET / HTTP/1.1
14:26:38.861814 IP6 amyrose.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.50168: Flags [P.], seq 1:190, ack 89, win 4, options [nop,nop,TS val 2946393551 ecr 1476158110], length 189: HTTP: HTTP/1.1 204 No Content
14:26:38.861816 IP6 amyrose.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.50168: Flags [F.], seq 190, ack 89, win 4, options [nop,nop,TS val 2946393554 ecr 1476158110], length 0
14:26:38.861871 IP6 rudra-HP-Laptop-15s-fr4xxx.50168 > amyrose.canonical.com.http: Flags [.], ack 190, win 256, options [nop,nop,TS val 1476158517 ecr 2946393551], length 0
14:26:38.862303 IP6 rudra-HP-Laptop-15s-fr4xxx.50168 > amyrose.canonical.com.http: Flags [F.], seq 89, ack 191, win 256, options [nop,nop,TS val 1476158518 ecr 2946393554], length 0
14:26:39.480760 IP6 amyrose.canonical.com.http > rudra-HP-Laptop-15s-fr4xxx.50168: Flags [.], ack 90, win 4, options [nop,nop,TS val 2946393961 ecr 1476158518], length 0

Note:(Include **screenshot** below **Output** and write **outcome** what you understand while run the network command.)