CSN-341 Computer Networks

27..11.2022

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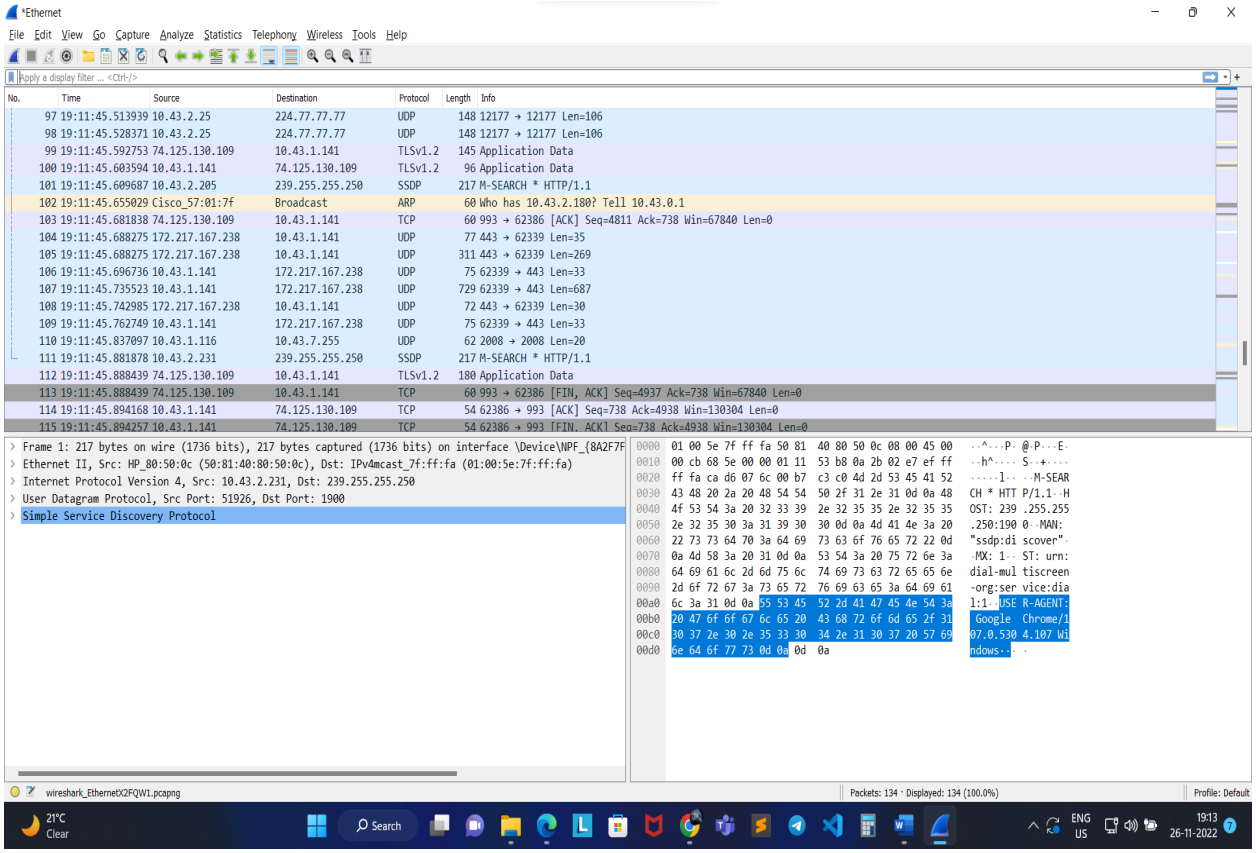
Task 1 : Wireshark

LAB : Getting Started

Ques1.)



The protocols appearing in the packets are:

1.) UDP
2.) TCP
3.) SSDP
4.) ARP
5.) TLSv1.2

Ques2.)

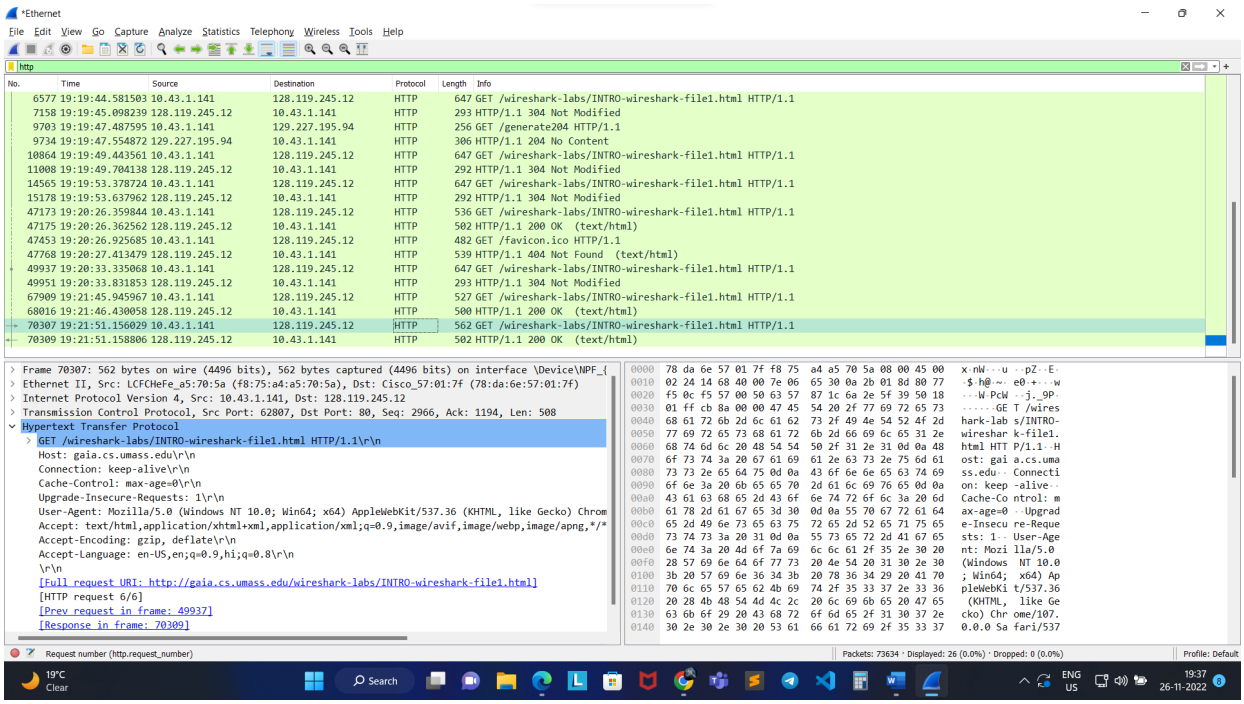
The get request was sent at time t = 19:21:51.156029 and the HTTP OK message was received at t = 19:21:51:158806.

Therefore the difference is : 0.002777 seconds

Ques3.)

The Internet address of the gaia.cs.umass.edu is 128.119.245.12 and the Internet address of my computer is 10.43.1.141.

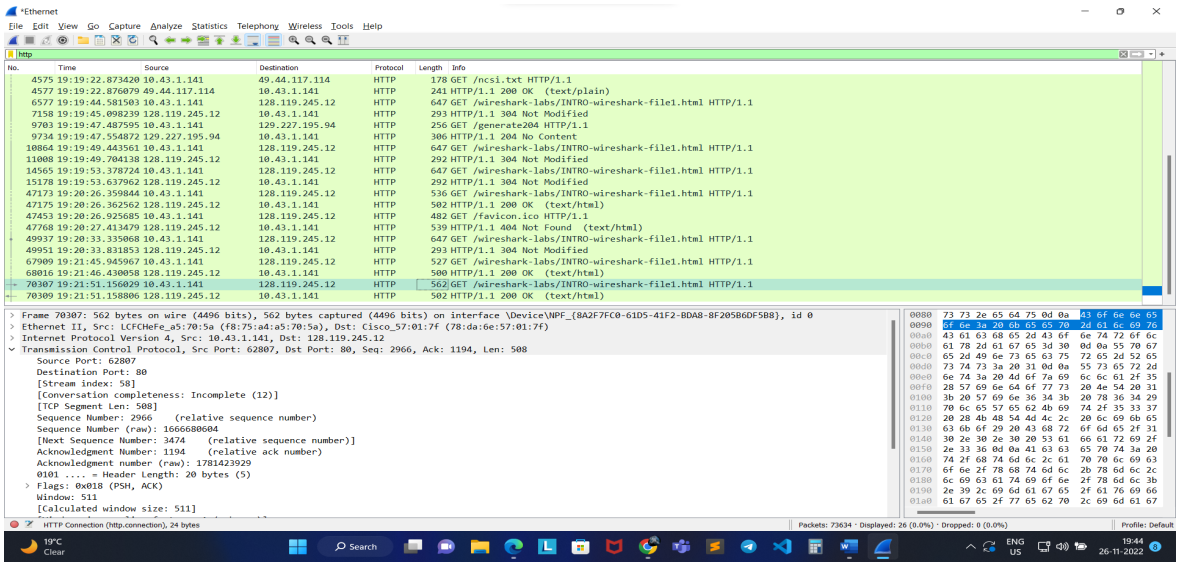
Ques4.)



The User-Agent Field has the value :

```
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/107.0.0.0 Safari/537.36\r\n
```

Ques5.) The destination port is 80.



Ques6.) HTTP GET and REPLY request on print command.

```
No.     Time              Source                Destination           Protocol Length Info
  70307 19:21:51.156029    10.43.1.141           128.119.245.12        HTTP     562    GET /wireshark-labs/INTRO-wireshark-file1.html HTTP/1.1
Frame 70307: 562 bytes on wire (4496 bits), 562 bytes captured (4496 bits) on interface \Device\NPF_{8A2F7FC0-61D5-41F2-BDA8-8F205B6DF5B8}, id 0
Ethernet II, Src: LCFCHeFe_a5:70:5a (f8:75:a4:a5:70:5a), Dst: Cisco_57:01:7f (78:da:6e:57:01:7f)
Internet Protocol Version 4, Src: 10.43.1.141, Dst: 128.119.245.12
Transmission Control Protocol, Src Port: 62807, Dst Port: 80, Seq: 2966, Ack: 1194, Len: 508
    Source Port: 62807
    Destination Port: 80
    [Stream index: 58]
    [Conversation completeness: Incomplete (12)]
    [TCP Segment Len: 508]
    Sequence Number: 2966    (relative sequence number)
    Sequence Number (raw): 1666680604
    [Next Sequence Number: 3474    (relative sequence number)]
    Acknowledgment Number: 1194    (relative ack number)
    Acknowledgment number (raw): 1781423929
    0101 .... = Header Length: 20 bytes (5)
    Flags: 0x018 (PSH, ACK)
    Window: 511
    [Calculated window size: 511]
    [Window size scaling factor: -1 (unknown)]
    Checksum: 0xcb8a [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
    [Timestamps]
    [SEQ/ACK analysis]
    TCP payload (508 bytes)
Hypertext Transfer Protocol
No.     Time              Source                Destination           Protocol Length Info
  70309 19:21:51.158806    128.119.245.12        10.43.1.141           HTTP     502    HTTP/1.1 200 OK  (text/html)
Frame 70309: 502 bytes on wire (4016 bits), 502 bytes captured (4016 bits) on interface \Device\NPF_{8A2F7FC0-61D5-41F2-BDA8-8F205B6DF5B8}, id 0
Ethernet II, Src: Cisco_57:01:7f (78:da:6e:57:01:7f), Dst: LCFCHeFe_a5:70:5a (f8:75:a4:a5:70:5a)
Internet Protocol Version 4, Src: 128.119.245.12, Dst: 10.43.1.141
Transmission Control Protocol, Src Port: 80, Dst Port: 62807, Seq: 1194, Ack: 3474, Len: 448
    Source Port: 80
    Destination Port: 62807
    [Stream index: 58]
    [Conversation completeness: Incomplete (12)]
    [TCP Segment Len: 448]
    Sequence Number: 1194    (relative sequence number)
    Sequence Number (raw): 1781423929
    [Next Sequence Number: 1642    (relative sequence number)]
    Acknowledgment Number: 3474    (relative ack number)
    Acknowledgment number (raw): 1666681112
    0101 .... = Header Length: 20 bytes (5)
    Flags: 0x018 (PSH, ACK)
    Window: 955
    [Calculated window size: 955]
    [Window size scaling factor: -1 (unknown)]
    Checksum: 0xa407 [unverified]
    [Checksum Status: Unverified]
    Urgent Pointer: 0
    [Timestamps]
    [SEQ/ACK analysis]
    TCP payload (448 bytes)
Hypertext Transfer Protocol
Line-based text data: text/html (3 lines)
```

LAB : HTTP

Ques1.)

My browser is running at HTTP 1.1 .

Ques2.)

```
Accept-Language: en-US,en;q=0.9\r\n
```

Ques3.)

The Internet address of the gaia.cs.umass.edu is 128.119.245.12 and the Internet address of my computer is 10.43.1.141.

Ques4.)

The status code returned from the browser is 200 OK .

Ques5.)

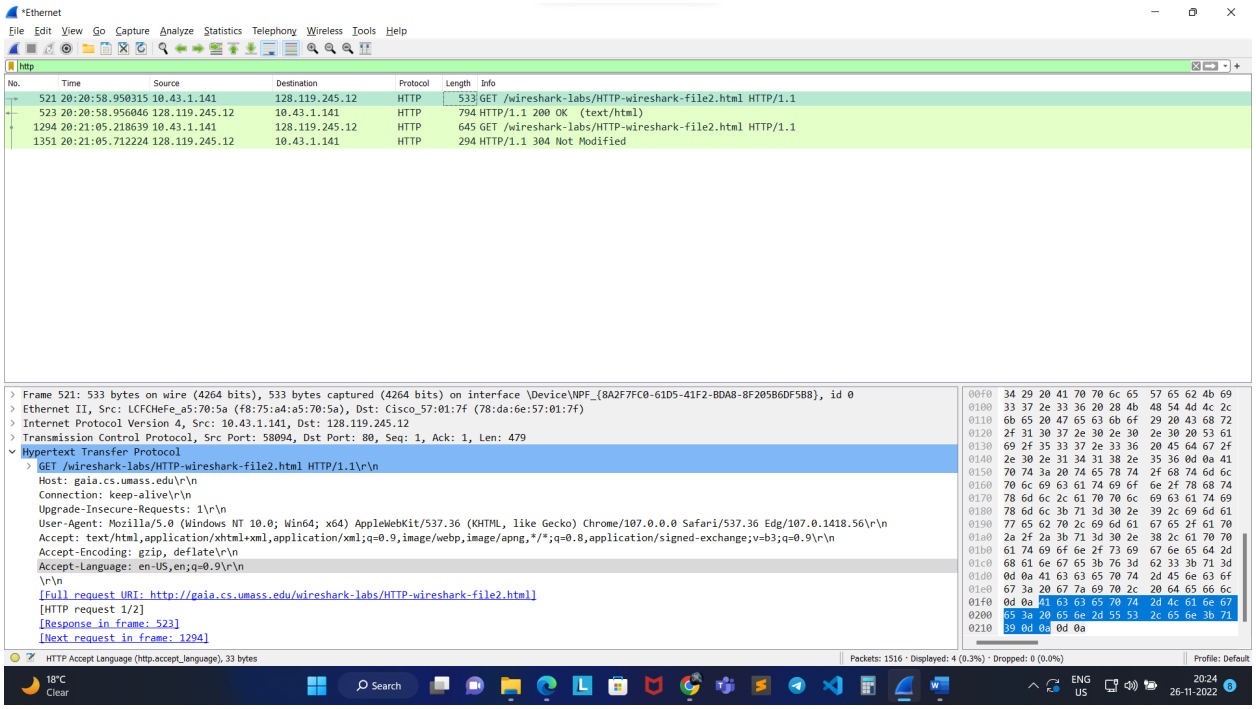
```
Last-Modified: Sat, 26 Nov 2022 06:59:01 GMT\r\n
```

Ques6.)

File data : 128 bytes.

Ques7.)

No, I don’t see any in the HTTP Message below.



Ques8.)

There is no IF-MODIFIED-SINCE in the first GET.

Ques9.)

Yes, the server explicitly return the file from the server to the browser.

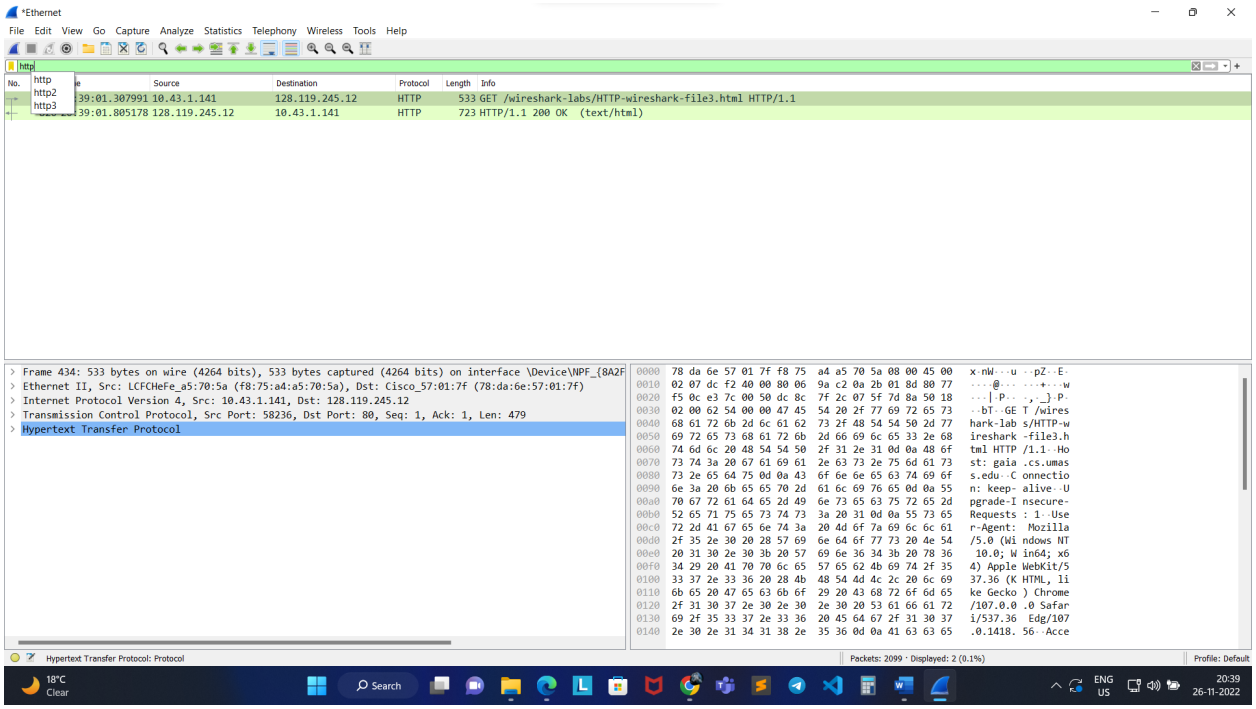
Ques10.)

Yes, there is an option of “IF-MODIFIED-SINCE” in the second HTTP GET request.

```
If-Modified-Since: Sat, 26 Nov 2022 06:59:01 GMT\r\n
```

Ques11.)

Status code received : 304 NOT MODIFIED. No, the server did not actually return the file.



Ques12.)

Only 1 HTTP GET request is sent by the browser. The packet number 434 in trace of Wireshark contains the GET request.

Ques13.)

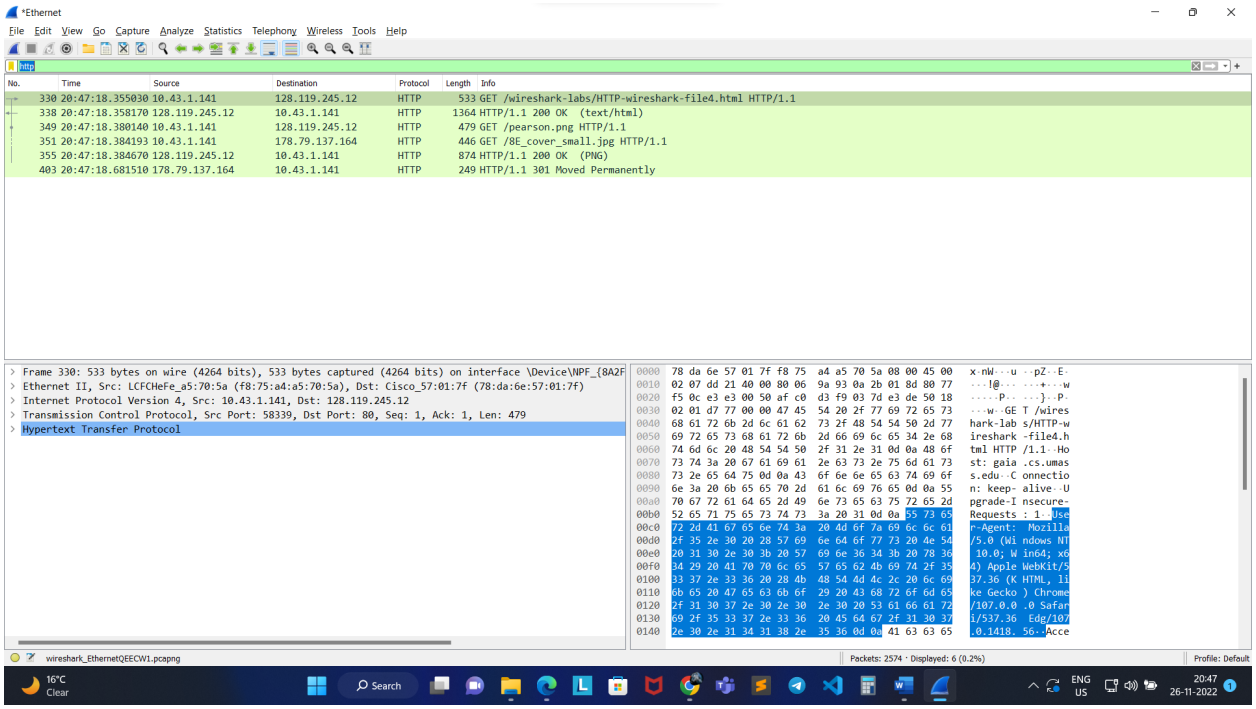
The packet number containing the status code and phrase associated is 132.

Ques14.)

Status code : 200 Phrase code : OK

Ques15.)

Number of data carrying packets : 4



Ques16.)

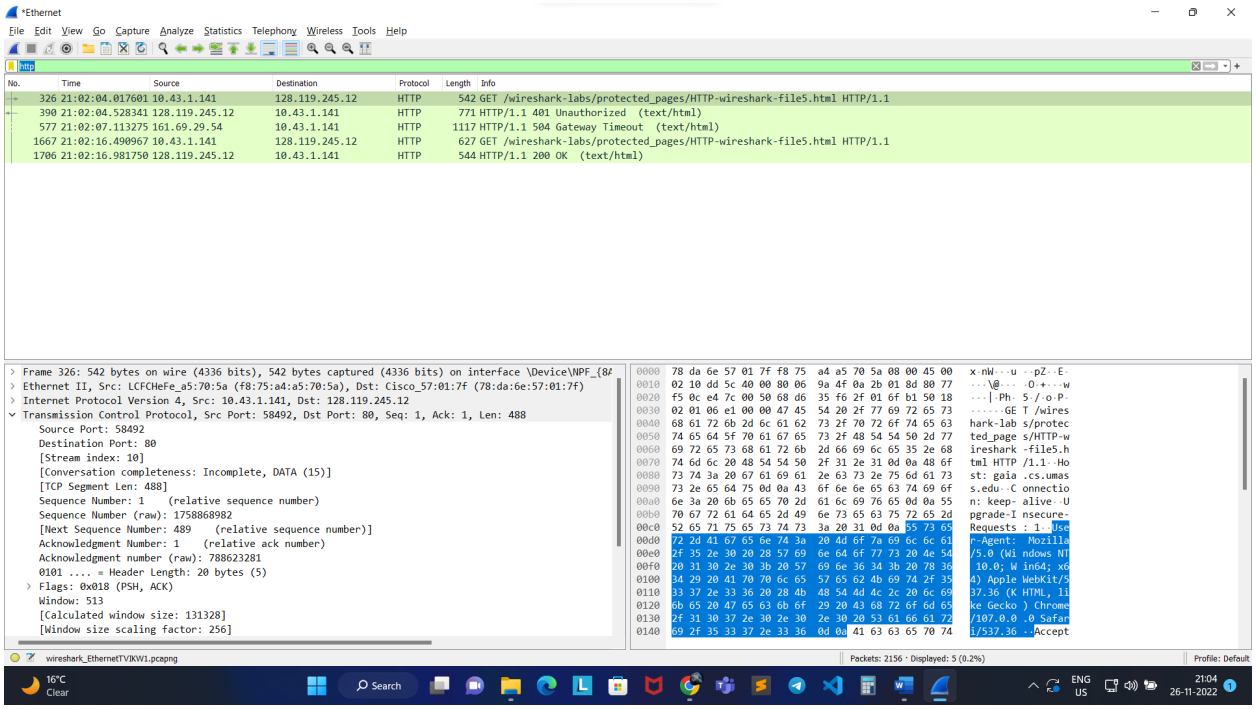
3 HTTP GET requests are sent by the browser. Two to the same destination IP address 128.119.245.12 and one to 178.79.137.164 .

Ques17.)

The downloads have occurred in parallel.

Sequence numbers of GET request : 349 and 351.

Sequence numbers of RESPONSE message : 355 and 403.



Ques18.)

The message received by the first GET message is : 401 UNAUTHORIZED

Ques19.)

The HTTP GET message now contains and additional field

```
Authorization: Basic d2lyZXNoYXJrLXN0dWRlbnRzOm5ldHdvcms=\r\n
```

LAB : DNS

```
Command Prompt

C:\Users\Akshat Agarwal>nslookup www.iitb.ac.in
Server:  umbva01.iitr.ac.in
Address:  192.168.108.121

Non-authoritative answer:
Name:    www.iitb.ac.in
Address:  103.21.124.10


C:\Users\Akshat Agarwal>nslookup -type=NS iitb.ac.in
Server:  umbva01.iitr.ac.in
Address:  192.168.108.121

iitr.ac.in
        primary name server = iitrdcad01.iitr.ac.in
        responsible mail addr = hostmaster.iitr.ac.in
        serial  = 15522
        refresh = 900 (15 mins)
        retry   = 600 (10 mins)
        expire  = 86400 (1 day)
        default TTL = 3600 (1 hour)

C:\Users\Akshat Agarwal>nslookup iitrdcad01.iitr.ac.in
Server:  umbva01.iitr.ac.in
Address:  192.168.108.121

Non-authoritative answer:
Name:    iitrdcad01.iitr.ac.in
Address:  192.168.101.11


C:\Users\Akshat Agarwal>_
```

Ques1.) The IP address of www.iitb.ac.in : 103.21.124.10 .

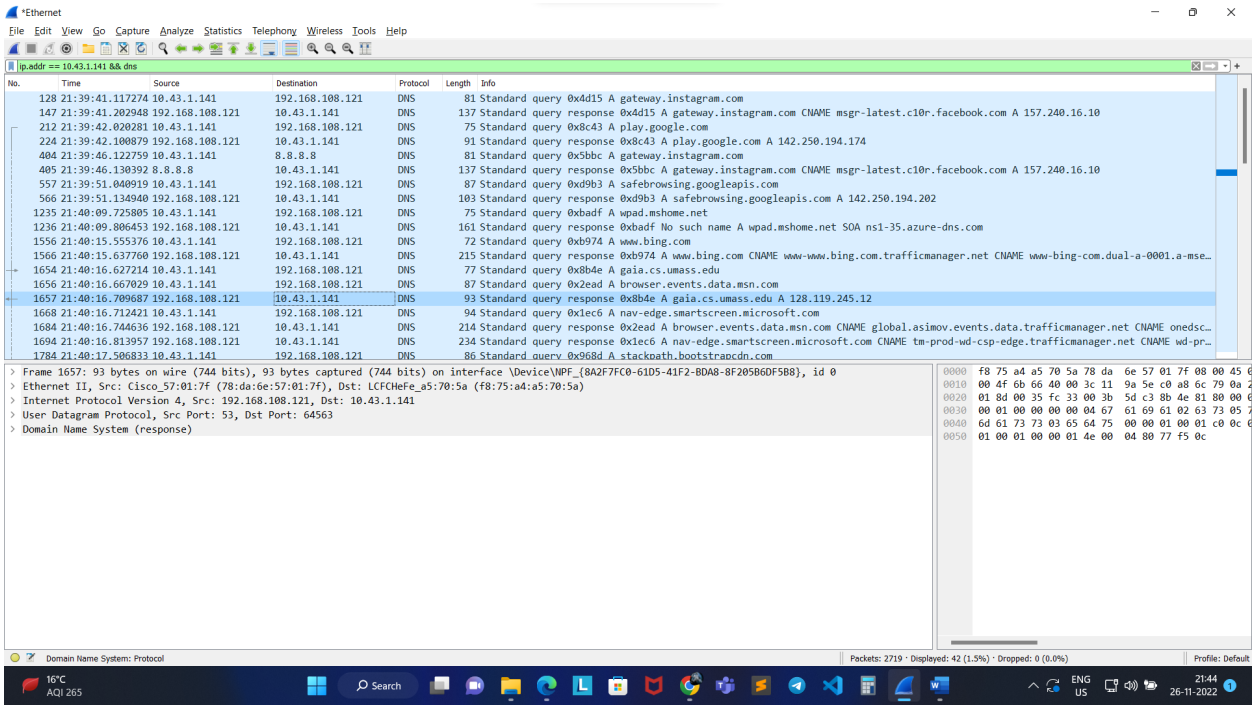
Ques2.) The IP address of the DNS server : 192.168.108.121

Ques3.) The answer comes from a non-authoritative answer.

Ques4.) Authoritative name server : iitrdcad01.iitr.ac.in . To find the IP address of an authoritative name server, we would run nslookup authorative_servername.

```
Command Prompt

C:\Users\Akshat Agarwal>ipconfig /flushdns

Windows IP Configuration

Successfully flushed the DNS Resolver Cache.

C:\Users\Akshat Agarwal>
```

Clearing the DNS cache.



Ques5.) The packet number for the first DNS to gaia.cs.umass.edu is 1654. The query is sent over UDP.

Ques6.) The packet number for the receiver packet is 1657. The response is received using the UDP protocol.

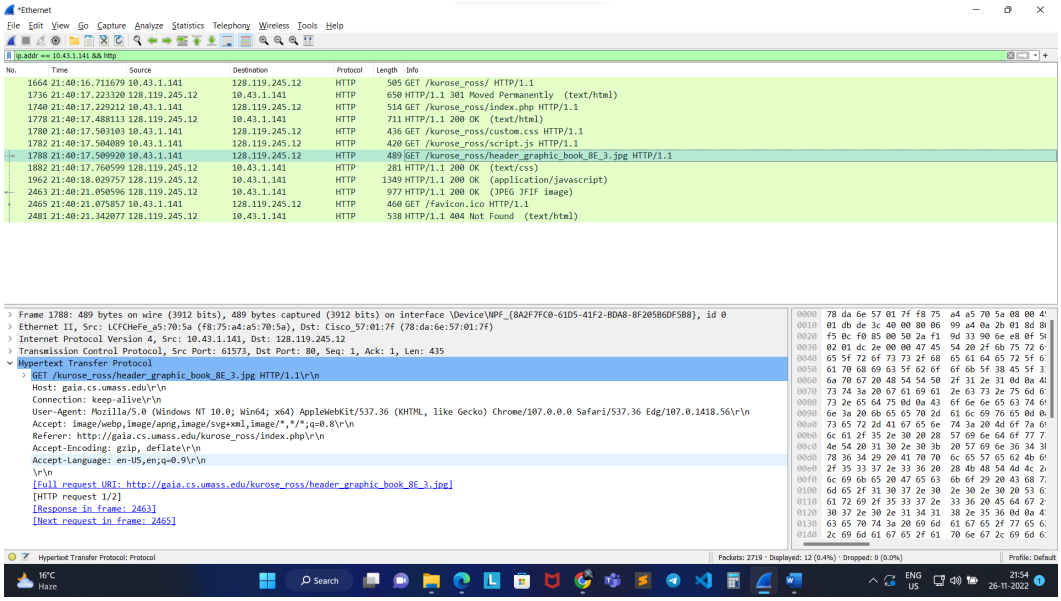
Ques7.) DNS query message: UDP Src port : 64563 Dest port : 53

DNS response message: UDP Src port : 53 Dest port : 64563

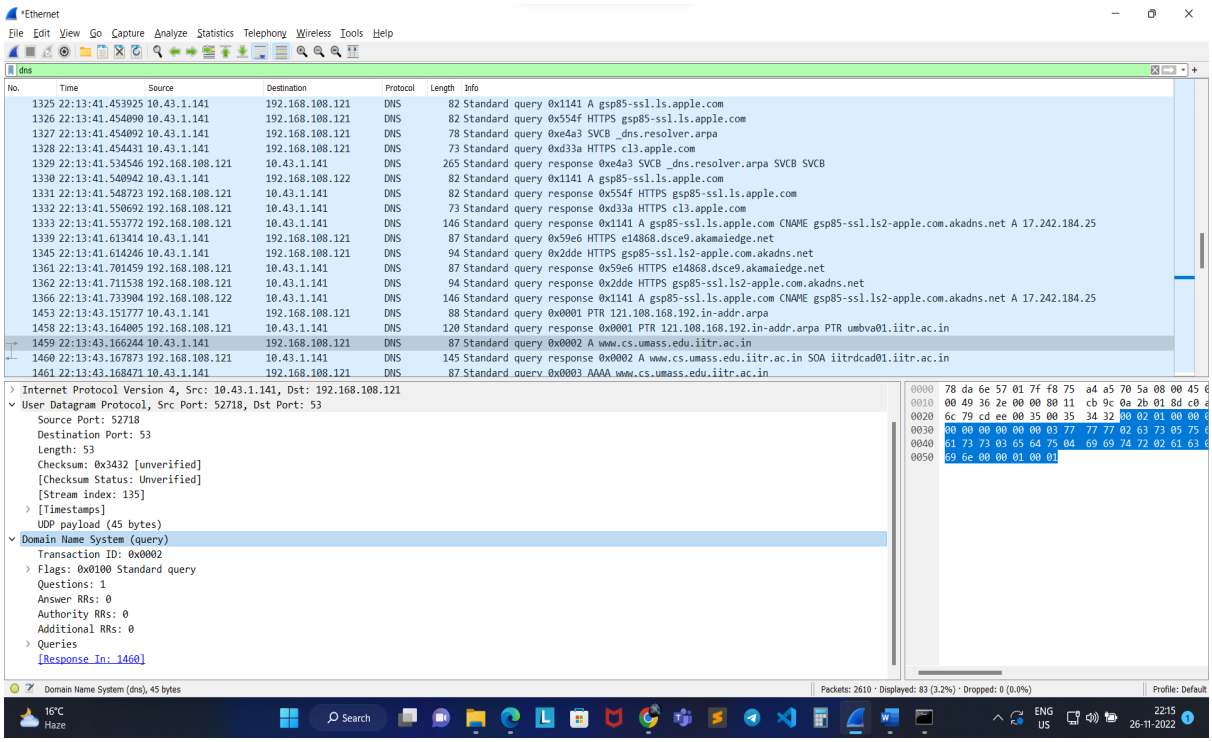
Ques8.) The DNS query is sent to 192.168.108.121 .

Ques9.) The DNS query message contains 1 question and 0 answers.

Ques10.) The DNS response message contains 1 question and 1 answer.



Ques11.) The DNS packet number in the trace of DNS query made to resolve gaia.cs.umass.edu so that this initial HTTP request can be sent to the gaia.cs.umass.edu IP address is 1658. The packet number of the DNS query is 1667. For the image file, the packet number is 1788. No additional query is sent to the DNS server for getting the IP address. Instead the DNS cache is used. The DNS cache tells the IP address of the address. No additional DNS query is required.

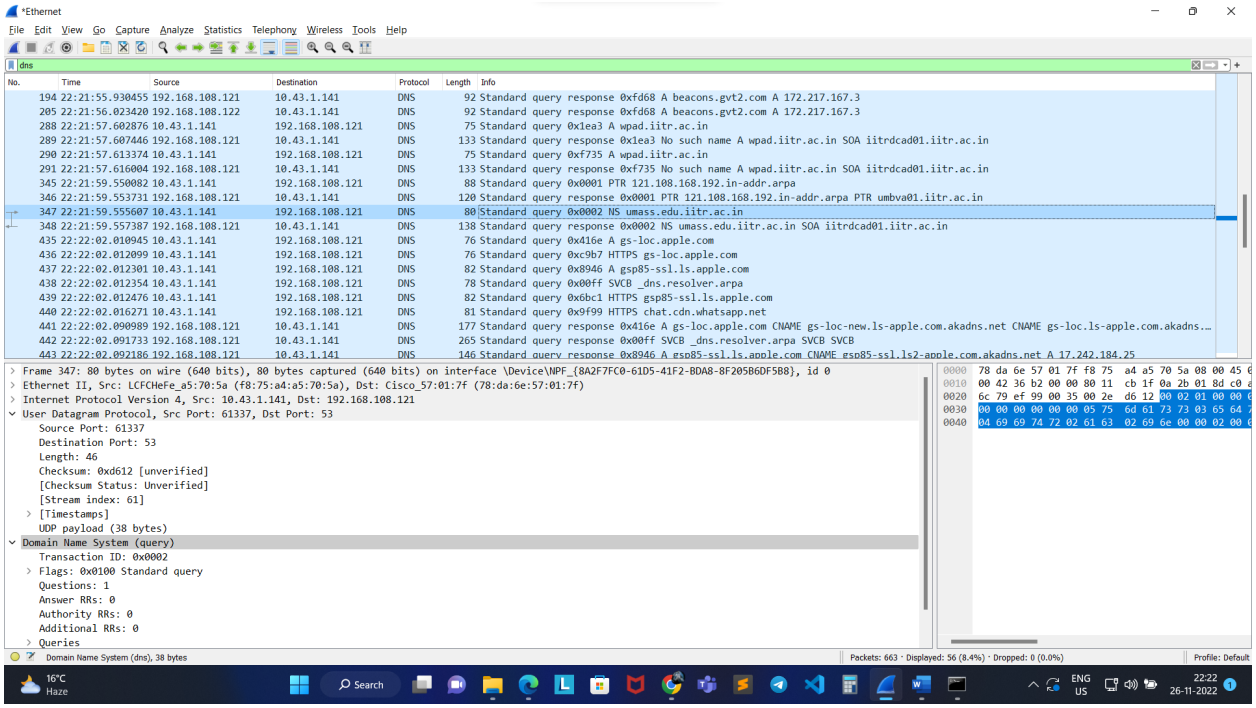


Ques12.) Destination port of the DNS query message is 53. The source port is : 52720 .

Ques13.) The DNS query message is sent to 192.168.108.121. This is the IP address of my default local DNS server.

Ques14.) Type of DNS query : A . No, this query does not contain any answers.

Ques15.) The DNS response message to the query message contains 1 question and 1 answer.

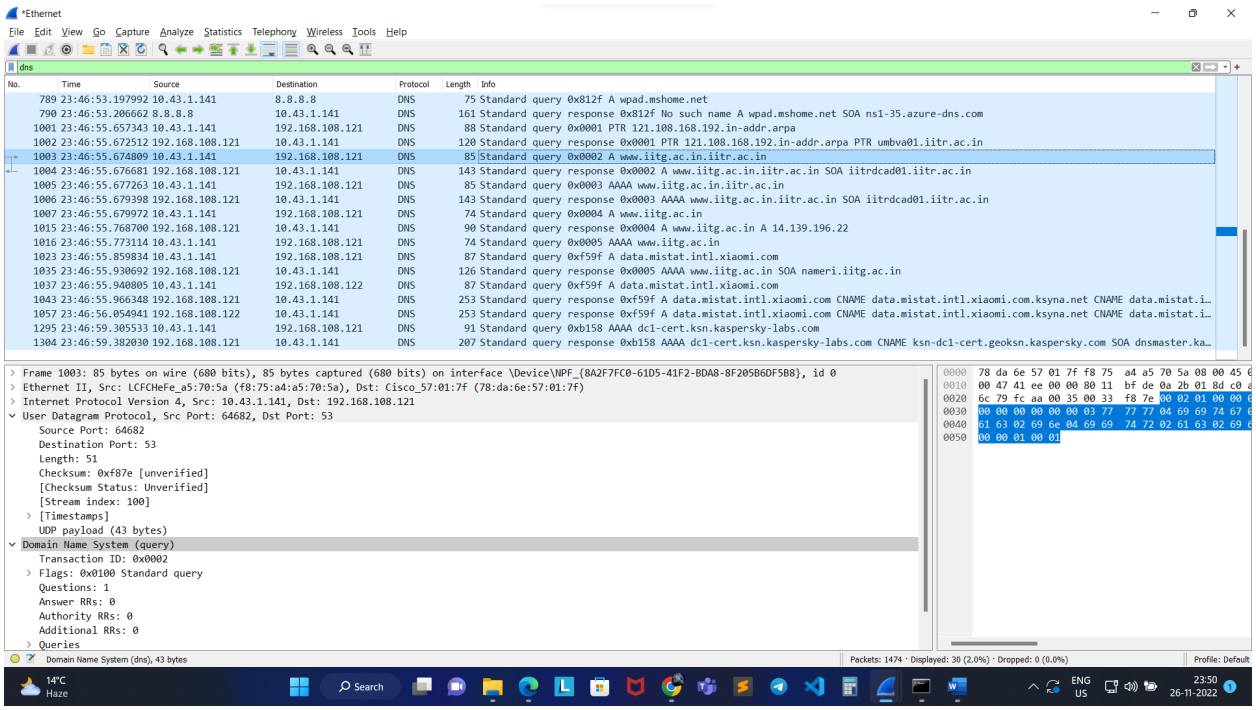


Ques16.) The DNS query is sent to 192.168.108.121 and this is the IP address of my local DNS server.

Ques17.) The DNS query has 1 question and 0 answers.

Ques18.) The DNS response in this case has 0 answers.

LAB : UDP



Ques1.) For the first UDP segment we have :

1.) The packet number in the first UDP segment is 1003.
2.) The UDP packet is carrying DNS application layer protocol.
3.) There are 4 fields in this UDP header.

```
User Datagram Protocol, Src Port: 64682, Dst Port: 53
    Source Port: 64682
    Destination Port: 53
    Length: 51
    Checksum: 0xf87e [unverified]
    [Checksum Status: Unverified]
    [Stream index: 100]
  > [Timestamps]
    UDP payload (43 bytes)
```

Ques2.)

1.) Source port length = 2 bytes
2.) Destination port length = 2 bytes
3.) Length field = 2 bytes
4.) Checksum length = 2 bytes

Ques3.) Length is the length of the UDP packet including both header and length.

Ques4.) There are 16 bits available for length. So the maximum length can be 2^16 -1 . In these 8 bytes will be for UDP header and network layer adds a minimum of 20 bytes of header length. So the maximum payload is 65507 bytes.

Ques5.) Largest possible port number : 2^16 -1 ;

Ques6.) The protocol number of UDP is 17.

Ques7.)

Packet number for query : 1003

Source port number : 64682

Destination port number : 53

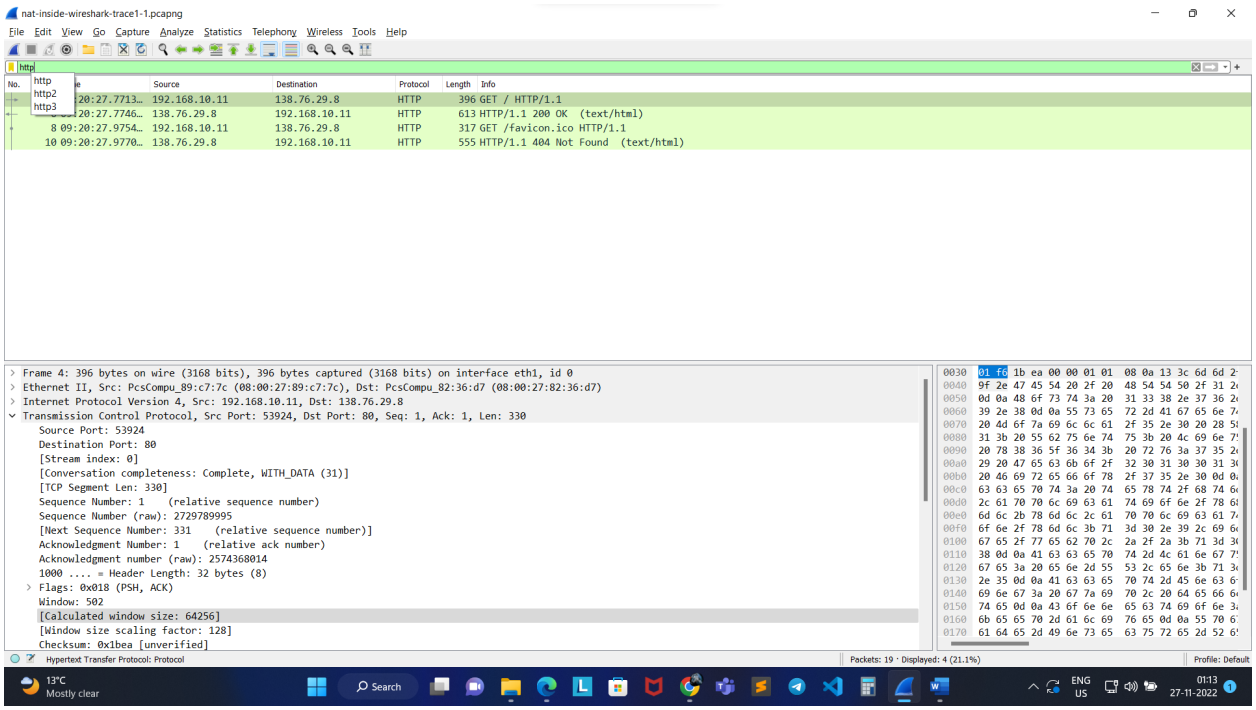
Packet number for response : 1004

Source port number : 53

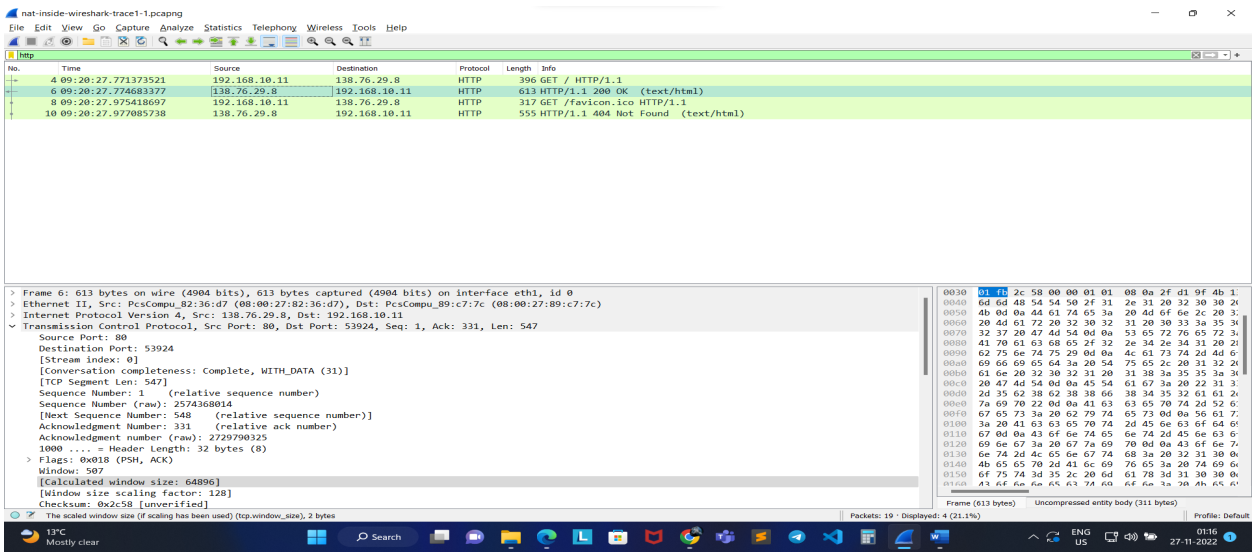
Destination port number : 64682

LAB : NAT

Ques1.) The IP address of the client that sends the HTTP GET request is 192.168.10.11 . The source port in the TCP segment is 53924. Destination IP address is : 138.76.29.8. Destination port number is 80.

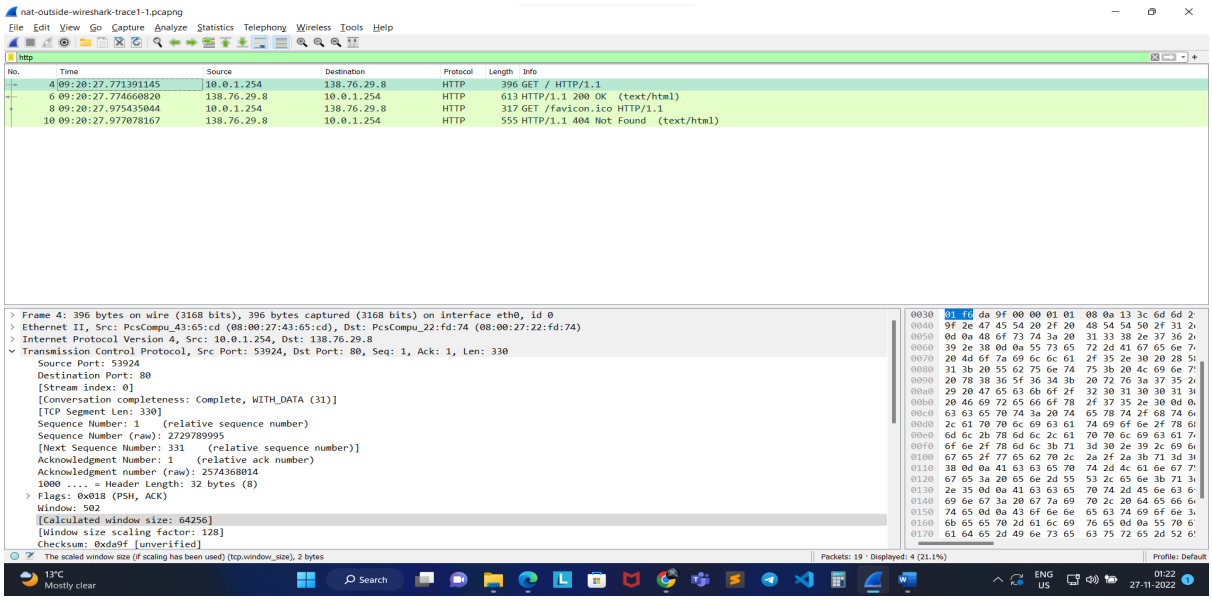


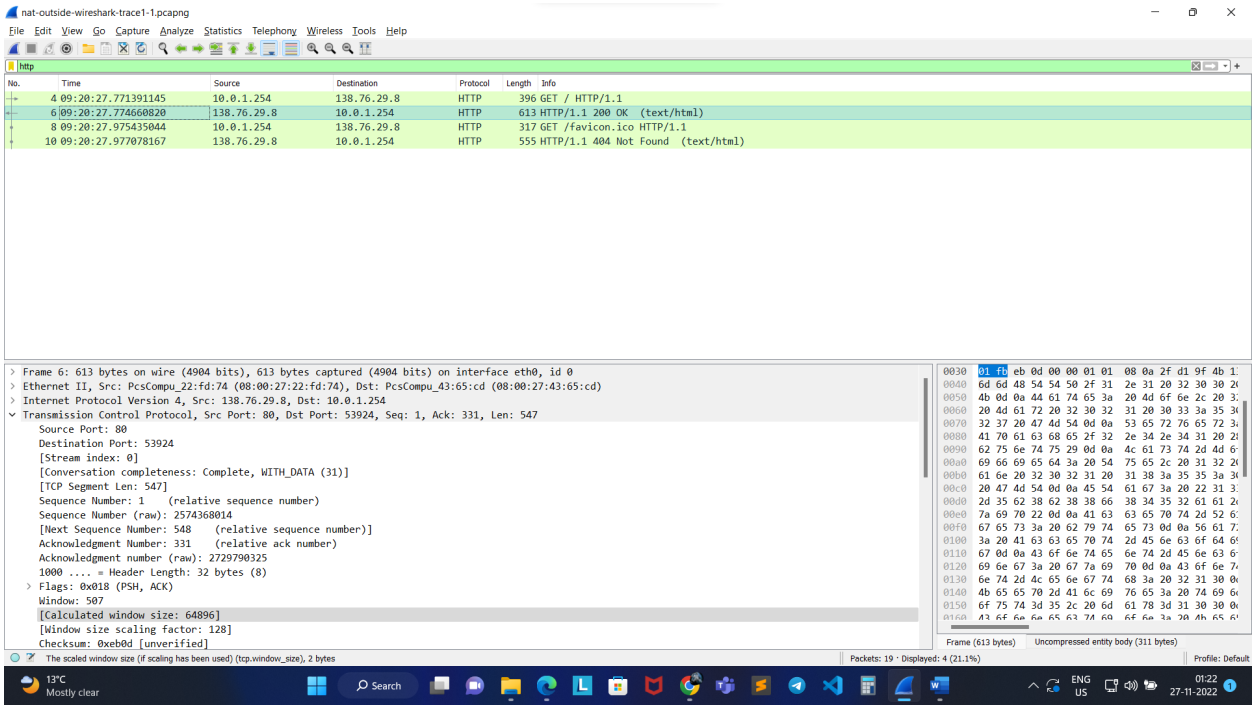
Ques2.) The difference is : 0.030672101



Ques3.)

1.) Source IP Address : 138.76.29.8 .
2.) Destination IP Address : 192.168.10.11
3.) Source Port : 80
4.) Destination Port number : 53924





Ques4.) At t = 0.027356291s, the HTTP GET message appears in NAT package capture.

Ques5.)

1.) Source IP Address : 10.0.1.254
2.) Destination IP Address : 138.76.29.8
3.) Source Port Number : 53924
4.) Destination Port Number : 80

Ques6.) The source address is different as compared to question 1.

Ques7.) No, HTTP GET message remains unchanged.

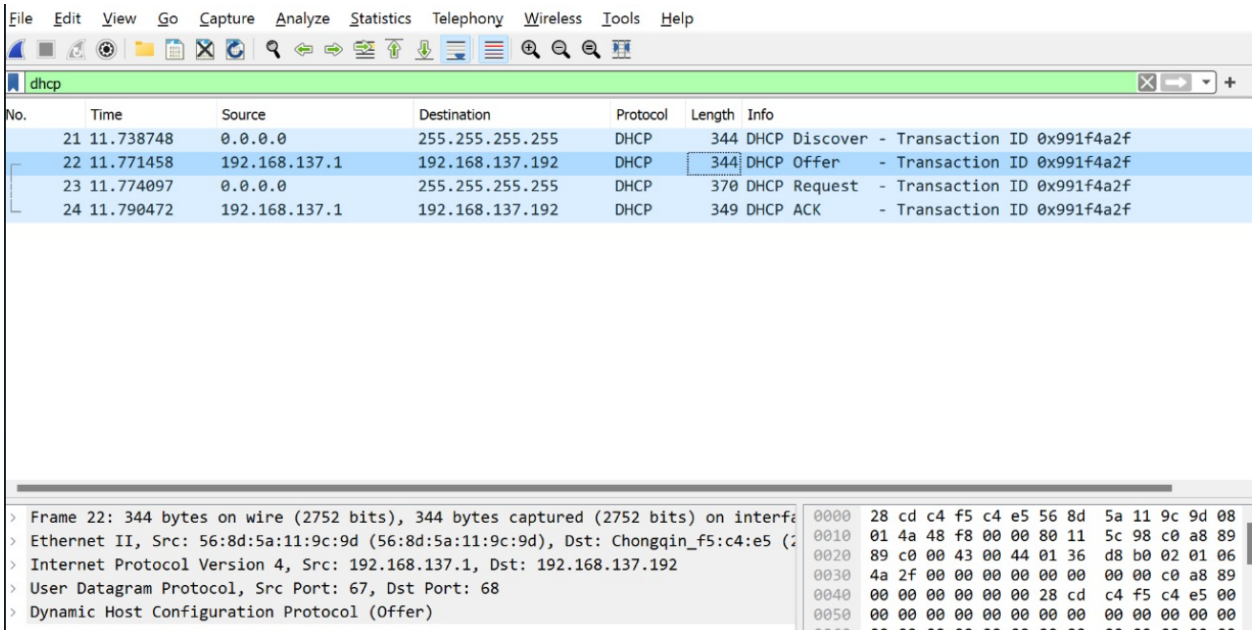
Ques8.) Version and Checksum are changed and Header length and Flags remain unchanged.

Ques9.) At t = 0.030625966, the received ACK message is received.

Ques10.)

1.) Source IP Address : 138.76.29.8
2.) Destination Address: 10.0.1.254
3.) Source Port : 80
4.) Destination Port : 53924

LAB : DHCP



Ques1.) The DHCP DISCOVER message is sent using the UDP protocol.

Ques2.) Source IP = 0.0.0.0 . This address is used to designate an invalid or unknown host.

Ques3.) Destination IP = 255.255.255.255 . This is the broadcast address.

Ques4.) Transaction ID = 0x2ce974f3

Ques5.) The client is requesting for following options:

```
Option: (53) DHCP Message Type (Discover)
Option: (61) Client identifier
Option: (50) Requested IP Address (10.43.1.141)
Option: (12) Host Name
Option: (60) Vendor class identifier
Option: (55) Parameter Request List
Option: (255) End
```

Ques6.) We can say that this OFFER message was in response to DHCP DISCOVER message because they have the same transaction ID.

Ques7.) The source IP of DHCP OFFER message : 192.168.137.192 .

Ques8.) The destination IP address is 255.255.255.255 .

Ques9.) It is providing following information :

```
> Option: (53) DHCP Message Type (Offer)
> Option: (1) Subnet Mask (255.255.248.0)
> Option: (58) Renewal Time Value
> Option: (59) Rebinding Time Value
> Option: (51) IP Address Lease Time
> Option: (54) DHCP Server Identifier (192.168.101.11)
> Option: (3) Router
> Option: (6) Domain Name Server
> Option: (15) Domain Name
> Option: (255) End
```

Ques10.) Source Port : 68 Destination Port : 67

Ques11.) Source IP = 0.0.0.0 .

Ques12.) Destination IP = 255.255.255.255 . This is the broadcast message.

Ques13.) Transaction ID : 0x2ce974f3. Yes, it will match.

Ques14.) There is no difference between the OPTIONS field between DHCP DISCOVER message and DHCP OFFER message .

Ques15.) The source IP address in the IP datagram containing the ACK message is 192.168.137.1 . This is the address of the DHCP server that sends acknowledgement messages.

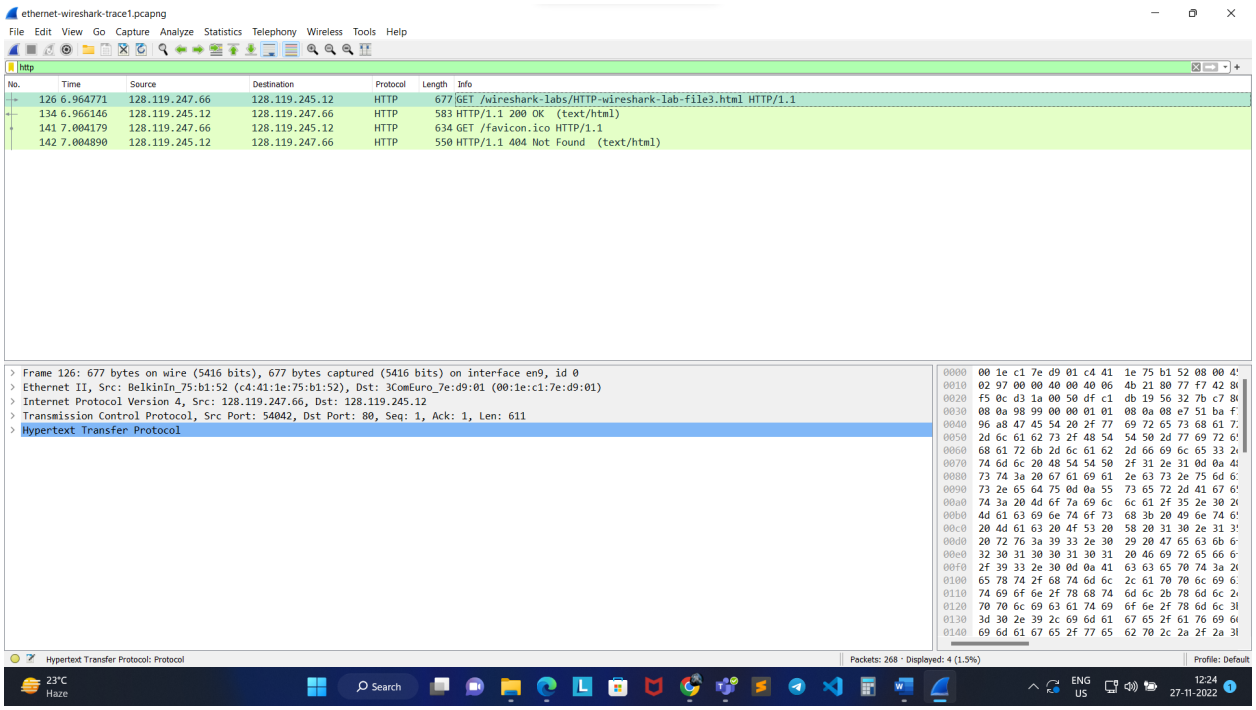
Ques16.) The destination IP : 255.255.255.255, as the client is still not assigned an IP address.

Ques17.) Is is : Your (Client) IP Address

Ques18.) The lease time is 30 minutes.

Ques19.) The first hop router has address is : 10.61.80.1

LAB : ETHERNET

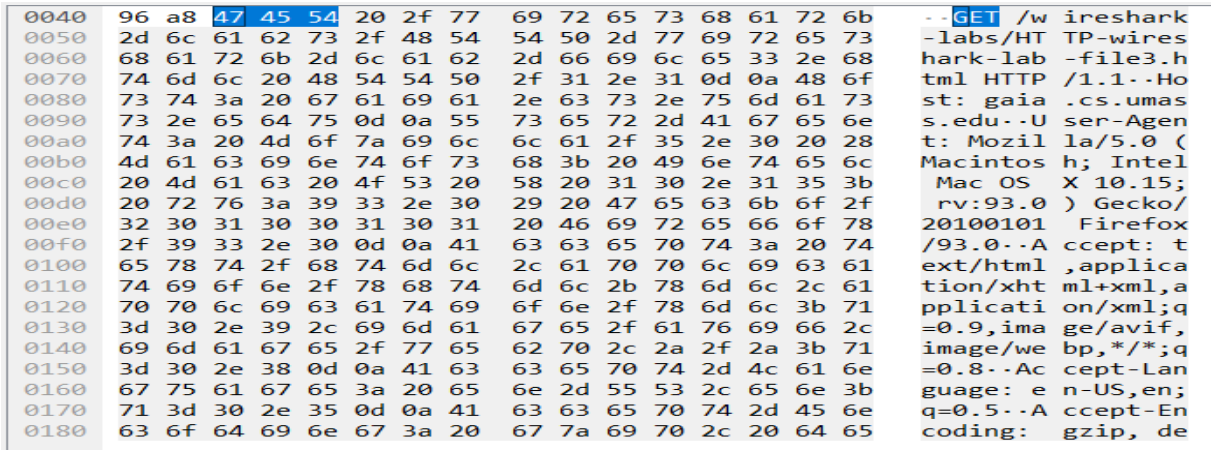


Ques1.) Ethernet Address : c4:41:1e:75:b1:52

Ques2.) Ethernet Destination Address : 00:1e:c1:7e:d9:01. This is the ethernet address of my next hop router. The ethernet frame is sent to the next router of mine, which then transports the packet off the link.

Ques3.) Type field : 0x0800 . This corresponds to the IPV4 protocol.

Ques4.) 54 bytes before the first letter.



Ques5.) Ethernet address : 00:1e:c1:7e:d9:01. This is the ethernet address of the next hop router of my computer.

Ques6.) Ethernet address of the destination : c4:41:1e:75:b1:52 . This is the ethernet address of my computer.

Ques7.) Type field : 0x0800. This corresponds to the IPv4 protocol of upper layers.

Ques8.) Here also 54 bytes from the beginning of the ethernet frame.

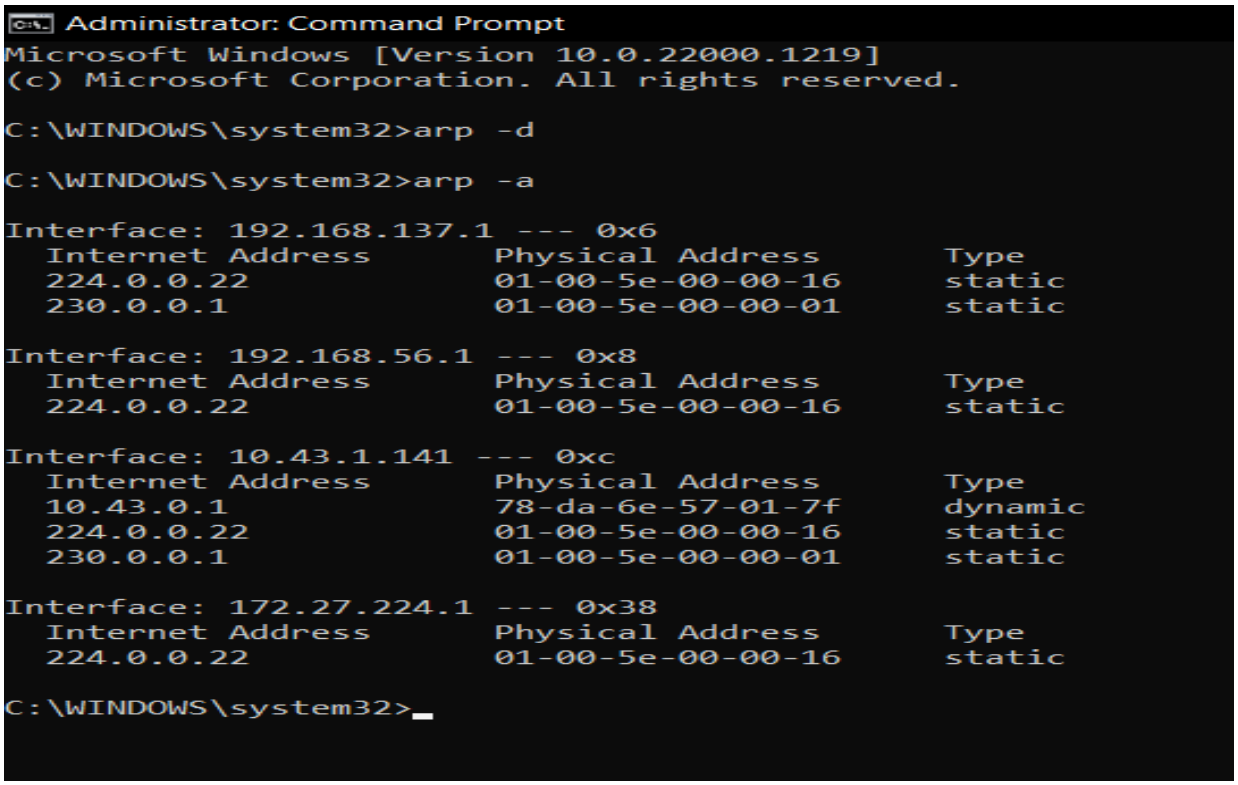
Ques9.) 4 ethernet frames were sent.

Ques10.)

```
Command Prompt
Microsoft Windows [Version 10.0.22000.1219]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Akshat Agarwal>arp -a

Interface: 192.168.137.1 --- 0x6
  Internet Address      Physical Address      Type
  192.168.137.2         f6-6e-47-a7-dd-7d     static
  192.168.137.16        16-ce-8c-c2-c6-15     static
  192.168.137.56        18-3e-ef-b9-6d-e8     static
  192.168.137.58        e8-5a-8b-48-e9-8d     static
  192.168.137.65        66-ab-e9-13-27-df     static
  192.168.137.78        be-1a-7f-87-e8-a2     static
  192.168.137.79        6c-6a-77-9b-d2-d2     static
  192.168.137.121       bc-17-b8-c5-d8-70     static
  192.168.137.142       90-e8-68-c7-5b-a9     static
  192.168.137.183       f6-26-58-4e-aa-dc     static
  192.168.137.192       28-cd-c4-f5-c4-e5     static
  192.168.137.197       86-3a-72-c4-e8-d9     static
  192.168.137.227       90-e8-68-c7-5b-a9     static
  192.168.137.251       5c-ba-ef-41-db-33     static
  192.168.137.255       ff-ff-ff-ff-ff-ff     static
  224.0.0.5             01-00-5e-00-00-05     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
  224.0.1.60            01-00-5e-00-01-3c     static
  224.77.77.77          01-00-5e-4d-4d-4d     static
  230.0.0.1             01-00-5e-00-00-01     static
  239.192.152.143       01-00-5e-40-98-8f     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

Interface: 192.168.56.1 --- 0x8
  Internet Address      Physical Address      Type
  192.168.56.255        ff-ff-ff-ff-ff-ff     static
  224.0.0.5             01-00-5e-00-00-05     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
  224.77.77.77          01-00-5e-4d-4d-4d     static
  230.0.0.1             01-00-5e-00-00-01     static
  239.255.255.250       01-00-5e-7f-ff-fa     static
```

Ques11.) Three things displayed in the ARP cache :

1.) IPv4 address
2.) MAC address
3.) Type



Ques12.) Source Address : 00:1e:c1:7e:d9:01

Ques13.)Destination address : ff:ff:ff:ff:ff:ff. This corresponds to the universal broadcast message.

Ques14.) Type field : ARP(0x0806). This corresponds to the ARP protocol.

Ques15.) 12 bytes from beginning the ARP opcode begins.

Ques16.) The value is : 0x0806 .

Ques17.) Yes, the ARP request message contains the IP address off the sender. The IP address is : 128.119.247.1 .

Ques18.) Target IP Address : 128.119.247.77

Ques19.) The value is : 0x0806 .

Ques20.) The Ethernet address corresponding to the IP address that was specified in the ARP request message sent by my computer is : 00:00:00:00:00:00.

Ques21.) Yes, we can see ARP packets from many other devices in the same network. We can see them because they were broadcasted to all the devices in the network.

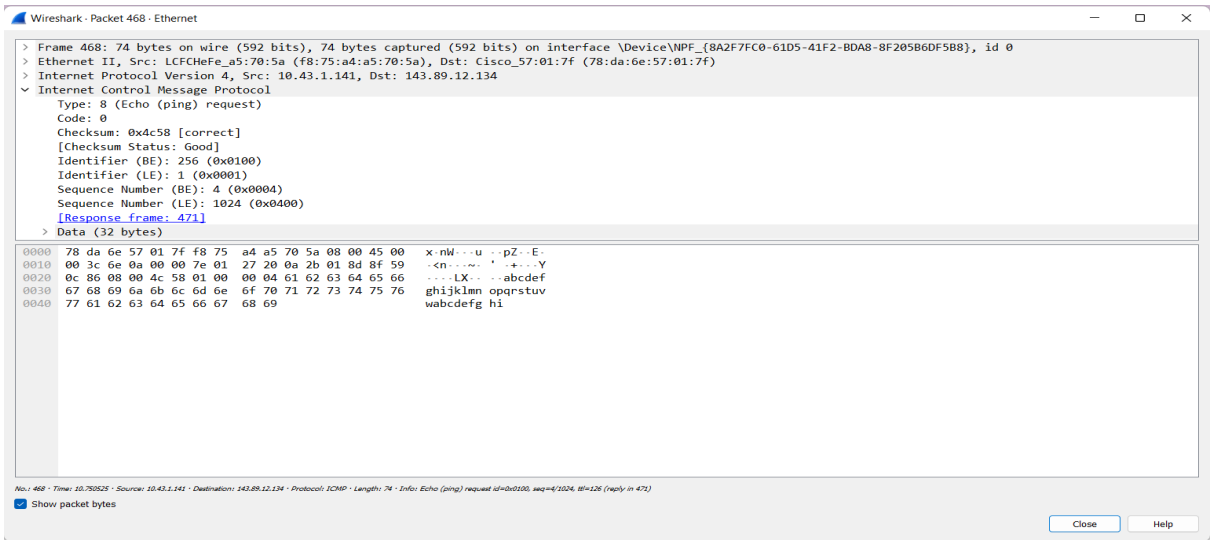
LAB : ICMP

```
Microsoft Windows [Version 10.0.22000.1219]
(c) Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>ping -n 10 www.ust.hk

Pinging www.ust.hk [143.89.12.134] with 32 bytes of data:
Reply from 143.89.12.134: bytes=32 time=105ms TTL=50
Reply from 143.89.12.134: bytes=32 time=106ms TTL=50
Reply from 143.89.12.134: bytes=32 time=106ms TTL=50
Reply from 143.89.12.134: bytes=32 time=106ms TTL=50
Reply from 143.89.12.134: bytes=32 time=107ms TTL=50
Reply from 143.89.12.134: bytes=32 time=107ms TTL=50
Reply from 143.89.12.134: bytes=32 time=107ms TTL=50
Reply from 143.89.12.134: bytes=32 time=105ms TTL=50
Reply from 143.89.12.134: bytes=32 time=105ms TTL=50
Reply from 143.89.12.134: bytes=32 time=105ms TTL=50

Ping statistics for 143.89.12.134:
    Packets: Sent = 10, Received = 10, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 105ms, Maximum = 107ms, Average = 105ms

C:\WINDOWS\system32>
```

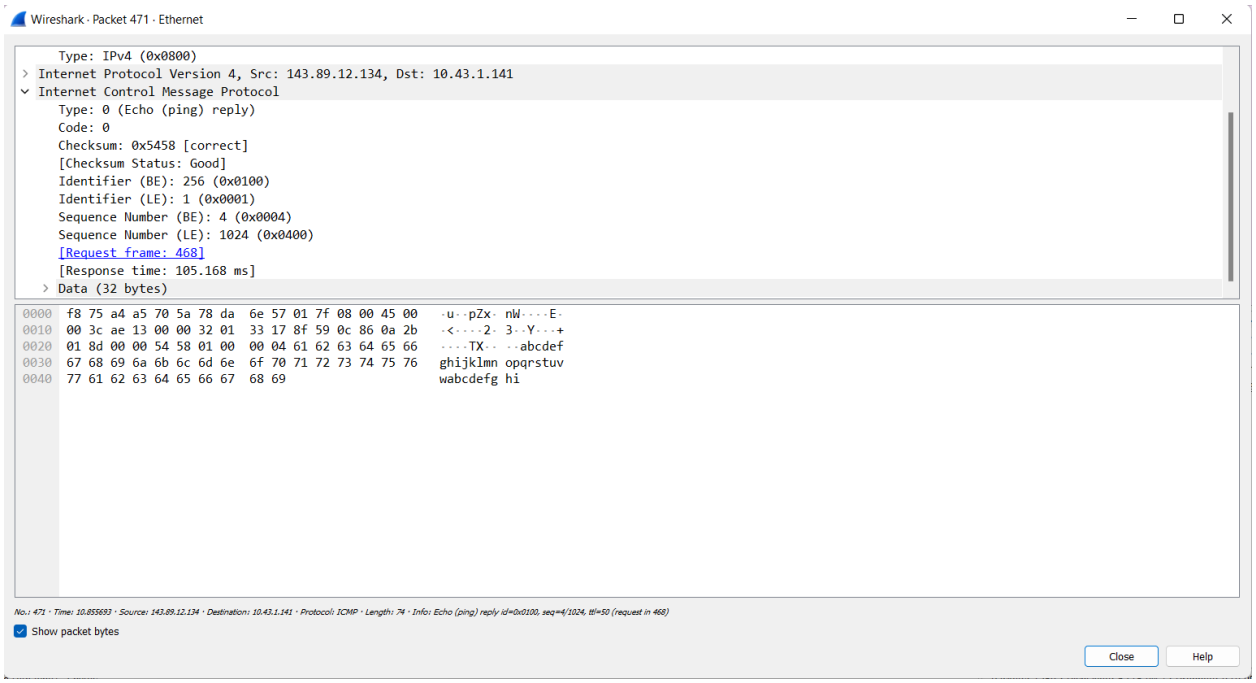
Ques1.) IP Source Address : 10.43.1.141 IP Destination Address : 143.89.12.134

Ques2.) Because it was designed to communicate network layer information between hosts and routers, not between application layer processes.

Ques3.)


Wireshark · Packet 468 · Ethernet
Frame 468: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface \Device\NPF_{8A2F7FC0-61D5-41F2-BDA8-8F205B6DF5B8}, id 0
Ethernet II, Src: LCFCHeFe_a5:70:5a (f8:75:a4:a5:70:5a), Dst: Cisco_57:01:7f (78:da:6e:57:01:7f)
Internet Protocol Version 4, Src: 10.43.1.141, Dst: 143.89.12.134
Internet Control Message Protocol
Type: 8 (Echo (ping) request)
Code: 0
Checksum: 0x4c58 [correct]
[Checksum Status: Good]
Identifier (BE): 256 (0x0100)
Identifier (LE): 1 (0x0001)
Sequence Number (BE): 4 (0x0004)
Sequence Number (LE): 1024 (0x0400)
[Response frame: 471]
Data (32 bytes)
0000 78 da 6e 57 01 7f f8 75 a4 a5 70 5a 08 00 45 00
0010 00 3c 6e 0a 00 00 7e 01 27 20 0a 2b 01 8d 8f 59
0020 0c 86 08 00 4c 58 01 00 00 04 61 62 63 64 65 66
0030 67 68 69 6a 6b 6c 6d 6e 6f 70 71 72 73 74 75 76
0040 77 61 62 63 64 65 66 67 68 69
Show packet bytes
Close
Help

Ques4.)


Wireshark · Packet 471 · Ethernet
Type: IPv4 (0x0800)
Internet Protocol Version 4, Src: 143.89.12.134, Dst: 10.43.1.141
Internet Control Message Protocol
Type: 0 (Echo (ping) reply)
Code: 0
Checksum: 0x5458 [correct]
[Checksum Status: Good]
Identifier (BE): 256 (0x0100)
Identifier (LE): 1 (0x0001)
Sequence Number (BE): 4 (0x0004)
Sequence Number (LE): 1024 (0x0400)
[Request frame: 468]
[Response time: 105.168 ms]
Data (32 bytes)
0000 f8 75 a4 a5 70 5a 78 da 6e 57 01 7f 08 00 45 00
0010 00 3c ae 13 00 00 32 01 33 17 8f 59 0c 86 0a 2b
0020 01 8d 00 00 54 58 01 00 00 04 61 62 63 64 65 66
0030 67 68 69 6a 6b 6c 6d 6e 6f 70 71 72 73 74 75 76
0040 77 61 62 63 64 65 66 67 68 69
Show packet bytes
Close
Help

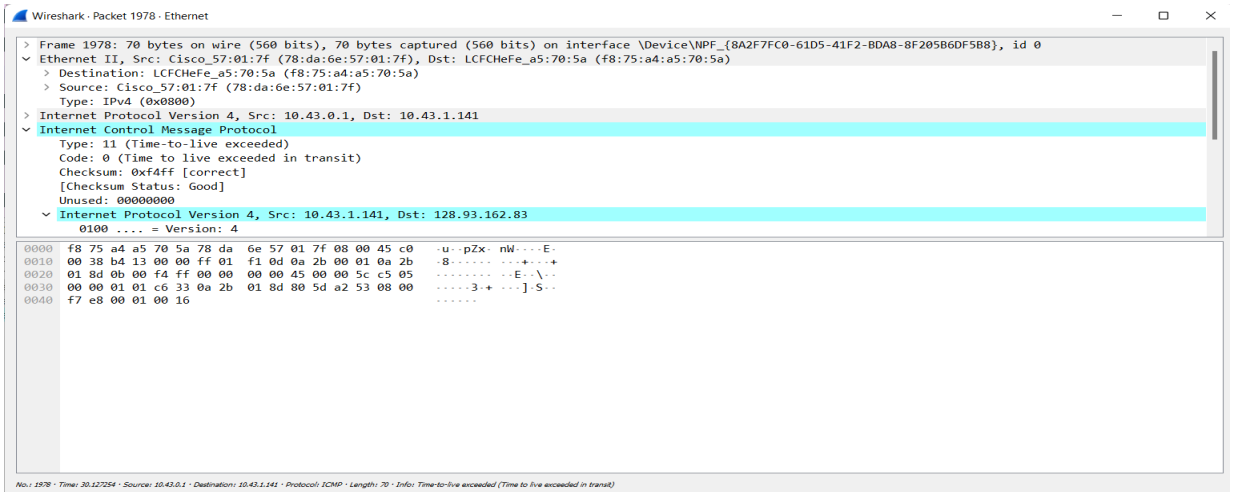
```
Administrator: Command Prompt
Microsoft Windows [Version 10.0.22000.1219]
(c) Microsoft Corporation. All rights reserved.

C:\WINDOWS\system32>tracert www.inria.fr

Tracing route to inria.fr [128.93.162.83]
over a maximum of 30 hops:

  1   601 ms      2 ms      6 ms  10.43.0.1
  2     1 ms      1 ms      1 ms  172.16.1.129
  3     *         *         *     Request timed out.
  4     *         *         *     Request timed out.
  5     *         *         *     Request timed out.
  6     *         *         *     Request timed out.
  7     *         *         *     Request timed out.
  8     *         *         *     Request timed out.
  9     *         *         *     Request timed out.
 10     *         *         *     Request timed out.
 11     *         *         *     Request timed out.
 12     *         *         *     Request timed out.
 13     *         *         *     Request timed out.
 14     *         *         *     Request timed out.
 15     *         *         *     Request timed out.
 16     *         *         *     Request timed out.
 17     *       236 ms    234 ms  prod-inriafr-cms.inria.fr [128.93.162.83]

Trace complete.

C:\WINDOWS\system32>
```

Ques5.) Source IP address : 192.168.137.192 Destination IP address : 128.93.162.83

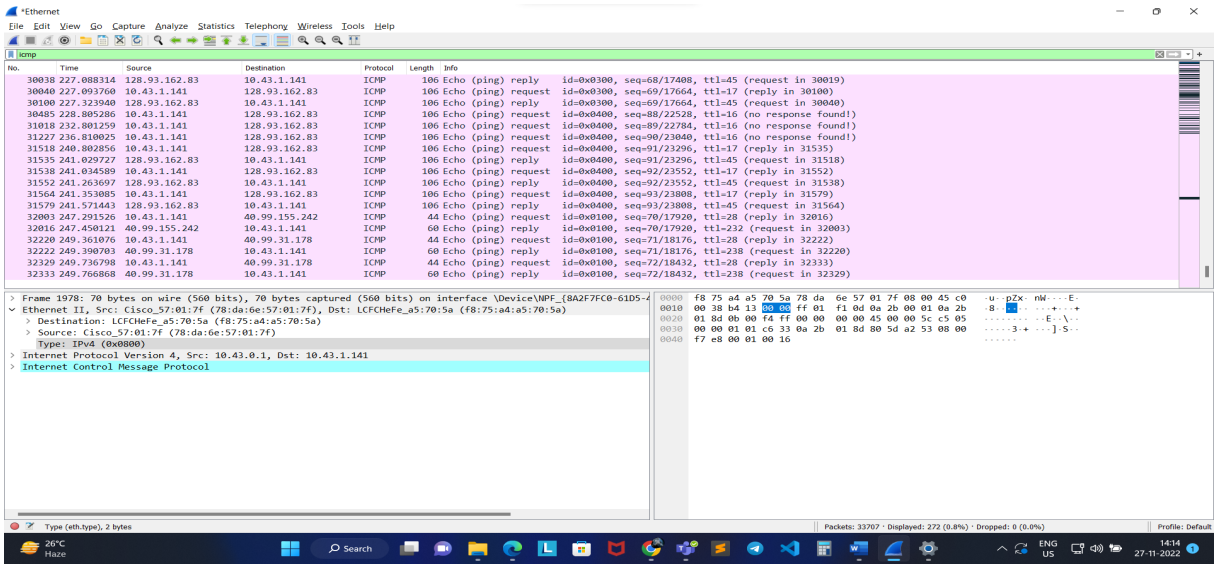
Ques6.) No, the protocol number would be 0x11.

Ques7.) The ICMP echo packet has the same fields as the ping query packets.

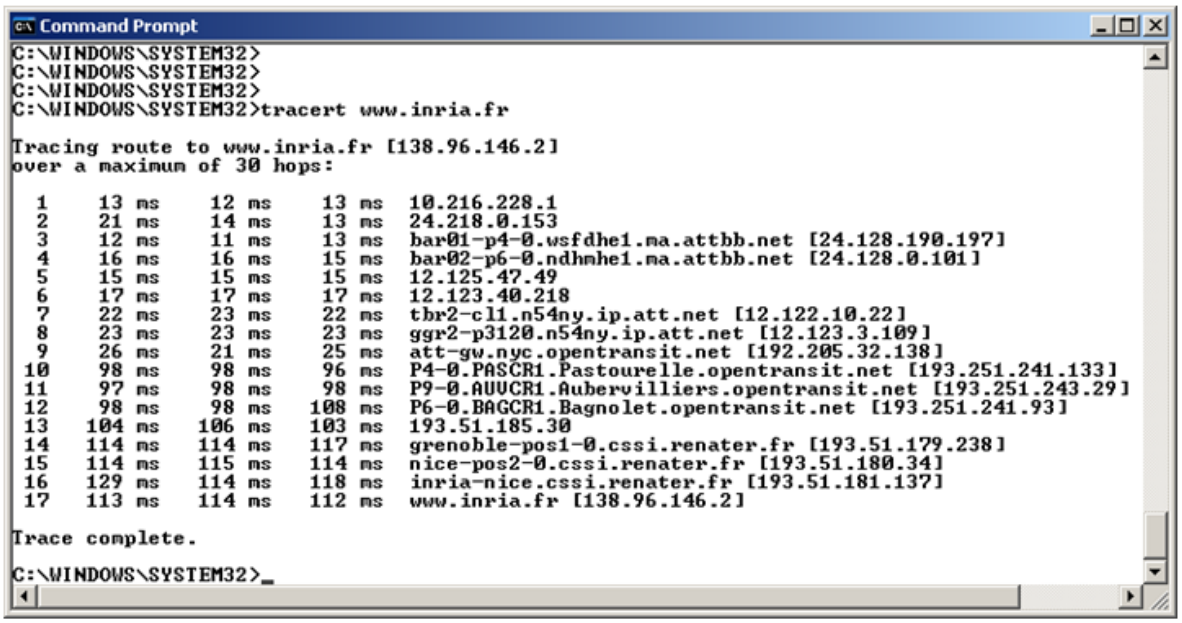
Ques8.) It contains both the IP header and the first 8 bytes of the original ICMP packet where the error is for.



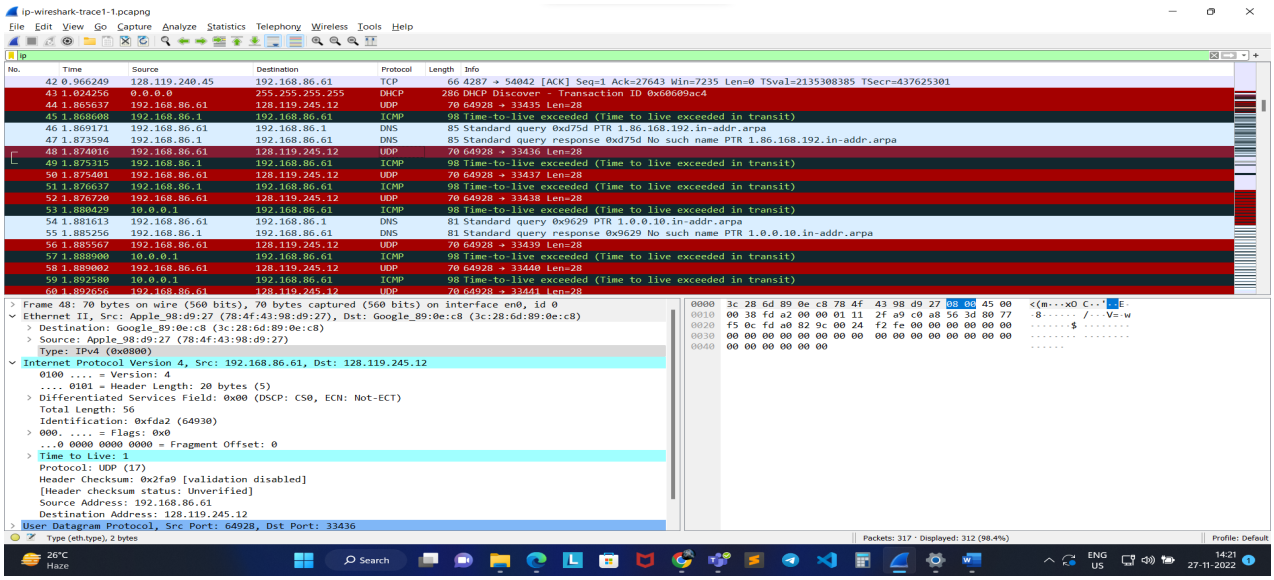
Ques9.) These last three are TYPE 0 instead of TTL expired. They are different because the datagrams have made it all the way to the destination host before the TTL expired.



Ques10.) Here we can see that from 9th message to 10th message there is a lot of time delay because we believe one router is located in New York City and the next hop router is located in France. Simply due to distance and speed of light it takes longer for the packet to respond.



LAB : IP



Ques1.) Source IP address : 192.168.86.61 .

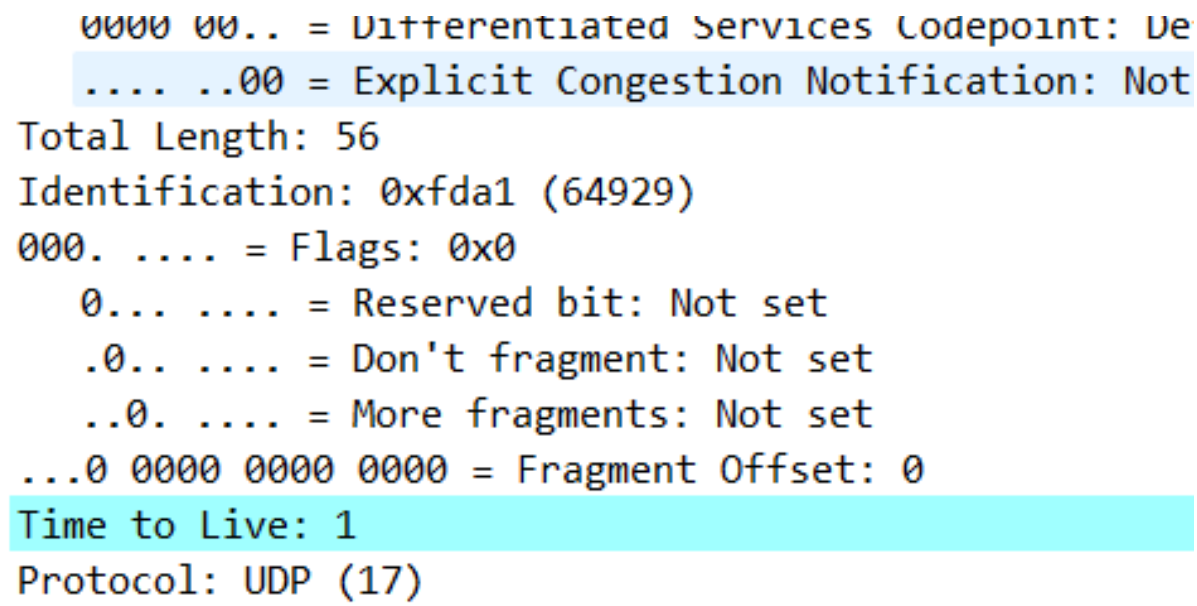
Ques2.) Time to Live field : 1

Ques3.) Upper layer Protocol : UDP (17)

Ques4.) Header Length = 20 bytes

Ques5.) Payload = Total length - Header = 56-20 = 36 bytes

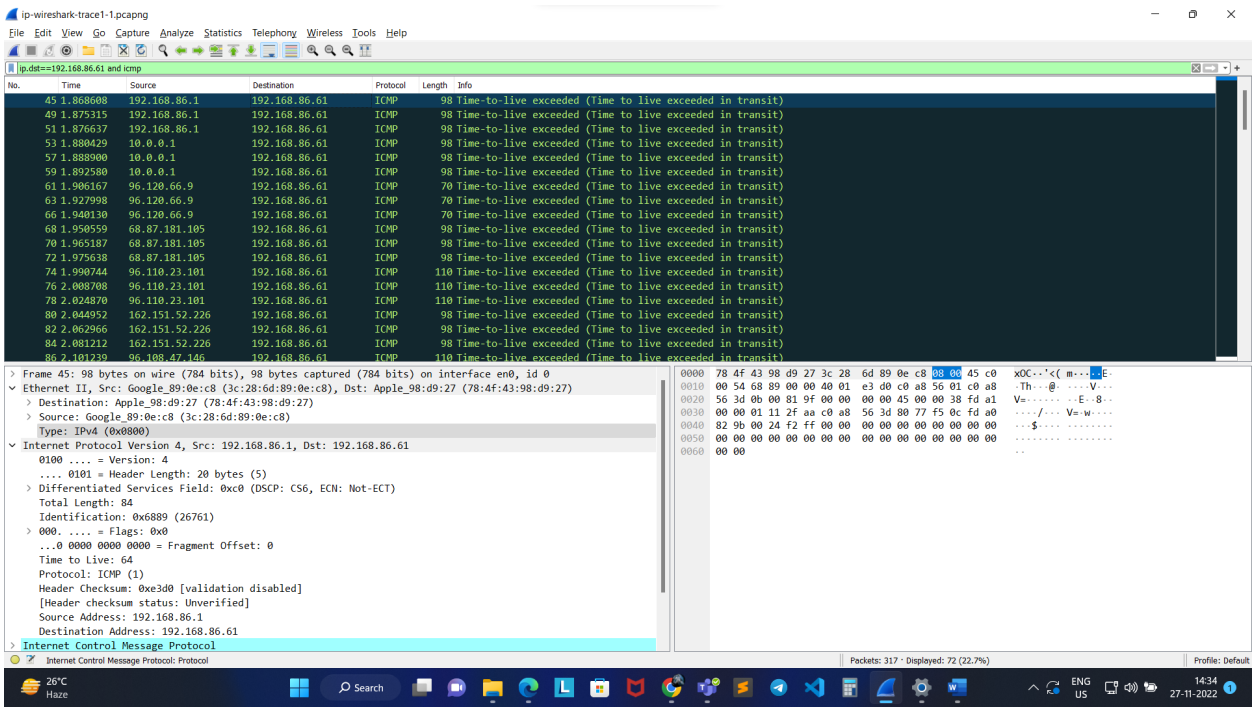
Ques6.) No , fragmentation is not done as More Fragments bit is not set.



Ques7.) Checksum field always changes as the value of Time to live field changes on every hop.

Ques8.) Identification number,Source IP address , Destination IP address etc. remains constant .

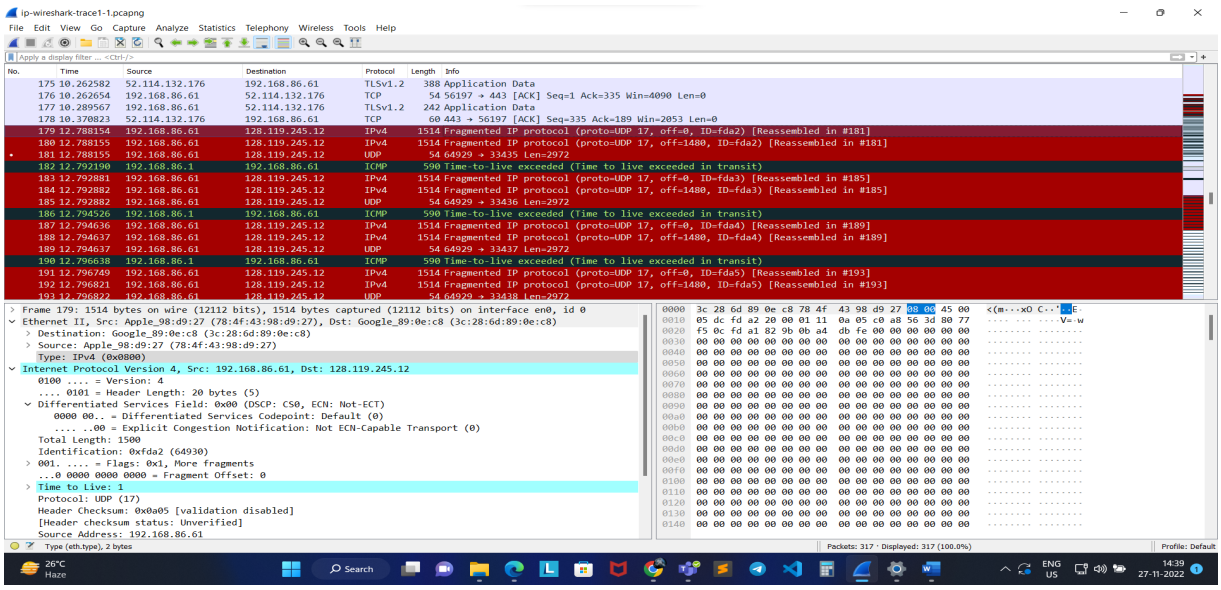
Ques9.) The pattern is that identification number increments after each ICMP ECHO request.



Ques10.) Upper layer protocol : ICMP(1)

Ques11.) Yes , the identification number in ICMP ECHO requests increments by one after each request..

Ques12.) The TTL field remains unchanged because the TTL for the first hop router is always the same.



Ques13.) Yes, there are 3 fragments.

Ques14.) The More Fragments bit is set to 1 in the IP header.

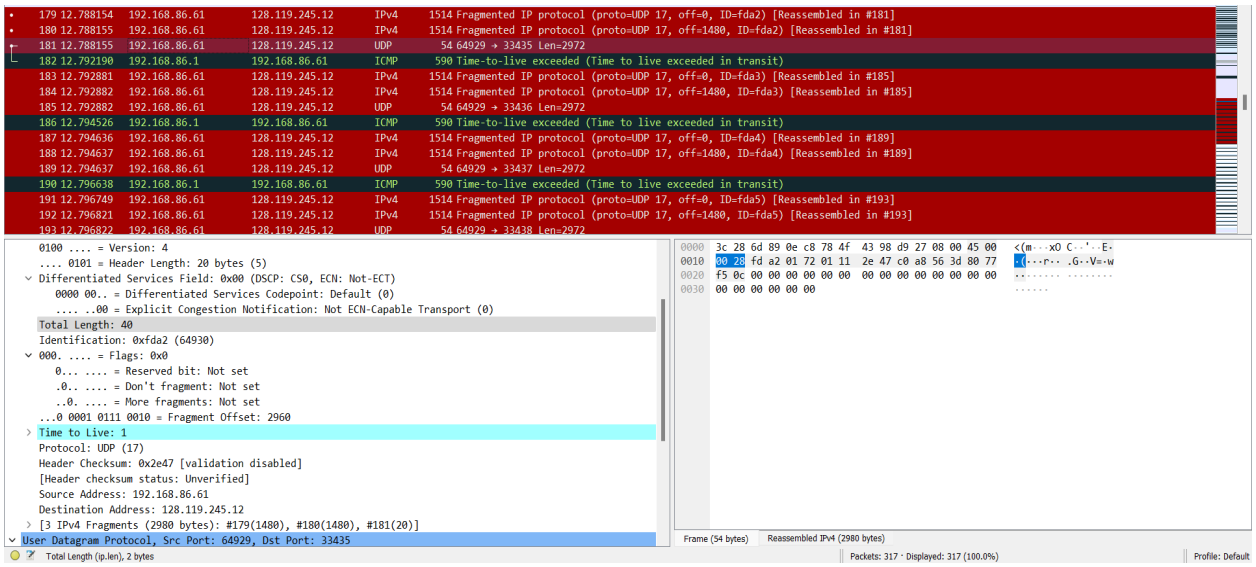
Ques15.) Since the Fragment Offset value is 0, this indicates that it is the first fragment.

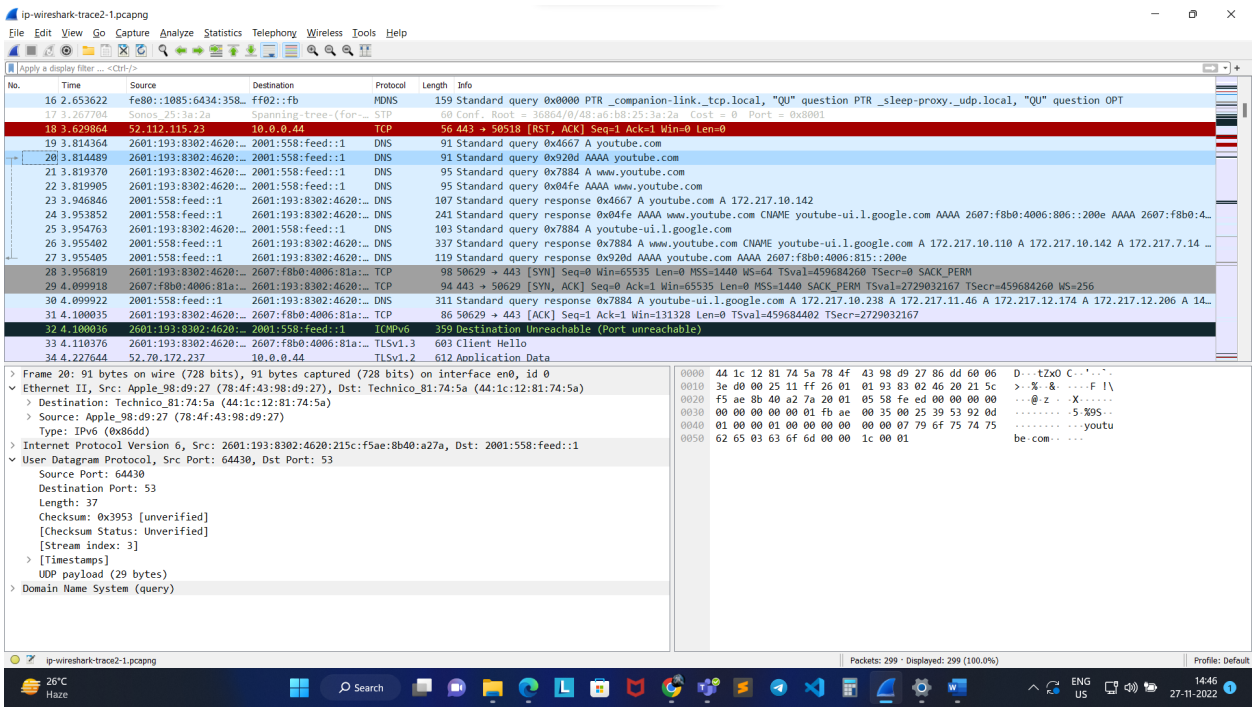
Ques16.) Total length = 1500 bytes.

Ques17.) Since the fragment offset is not equal to 0, this is not the first fragment.

Ques18.) The fields which change are fragment offset, time to live field, checksum etc.

Ques19.) Since the More Fragments bit is set to 0, this indicates that the fragment is the last fragment.





Ques20.) IPv6 Source address : `2601:193:8302:4620:215c:f5ae:8b40:a27a` .

Ques21.) IPv6 Destination address : `2001:558:feed::1`

Ques22.) Flow label : `Flow Label: 0x63ed0`

Ques23.) Payload length = 37

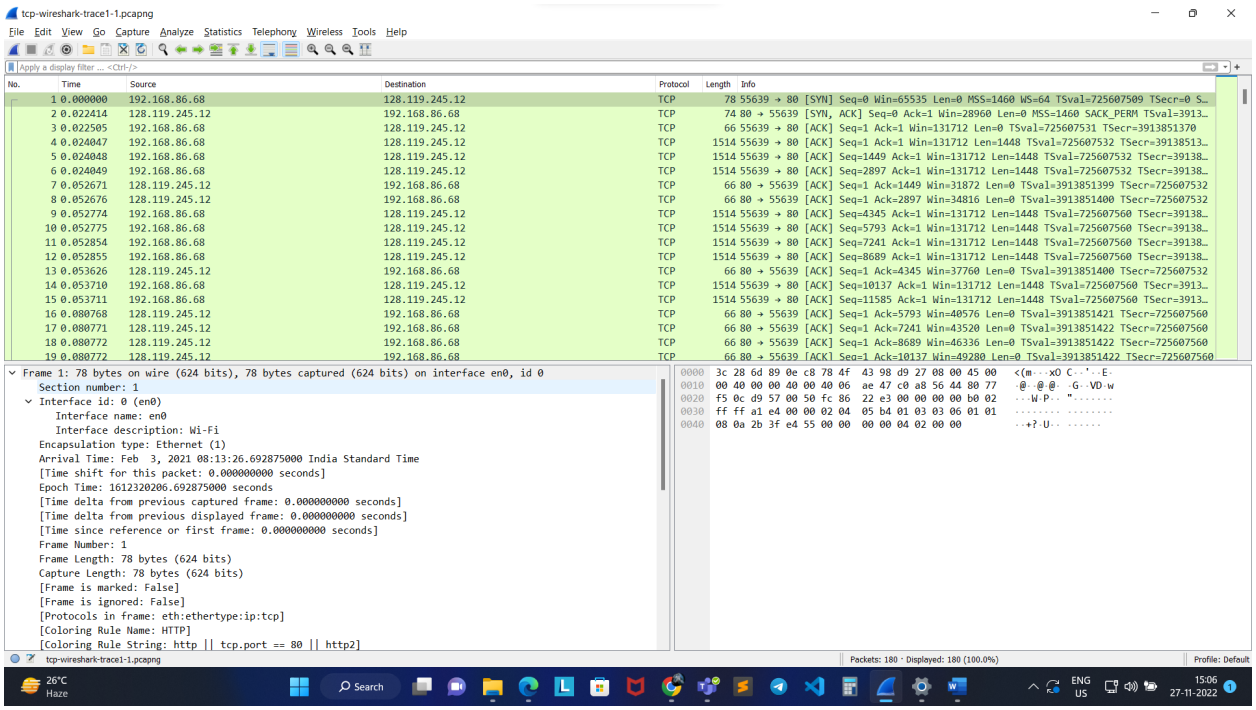
Ques24.) Upper layer protocol : UDP(17)

Ques25.) 1 IPv6 address is returned.

Ques26.) IPv6 address returned :

```
addr 2607:f8b0:4006:815::200e
```

LAB : TCP



Ques1.) IP source address : 192.168.86.68 TCP source port number : 55639

Ques2.) IP address : 128.119.245.12

Source port number : 80 Destination port number : 55639

Ques3.) Sequence number of SYN segment (RAW) : 4236649187 . It is identified as a SYN segment as the SYN flag is set .

Ques4.) Sequence number of SYNACK segment (RAW) : 1068969752 , acknowledgement number of the SYNACK segment (RAW) : 4236649188 . It is identified as SYNACK as SYN and ACK flags are set in this segment.

Ques5.) Sequence number (RAW) : 4236649188 , TCP payload data = 1448 bytes . No , the file is transferred in multiple segments.

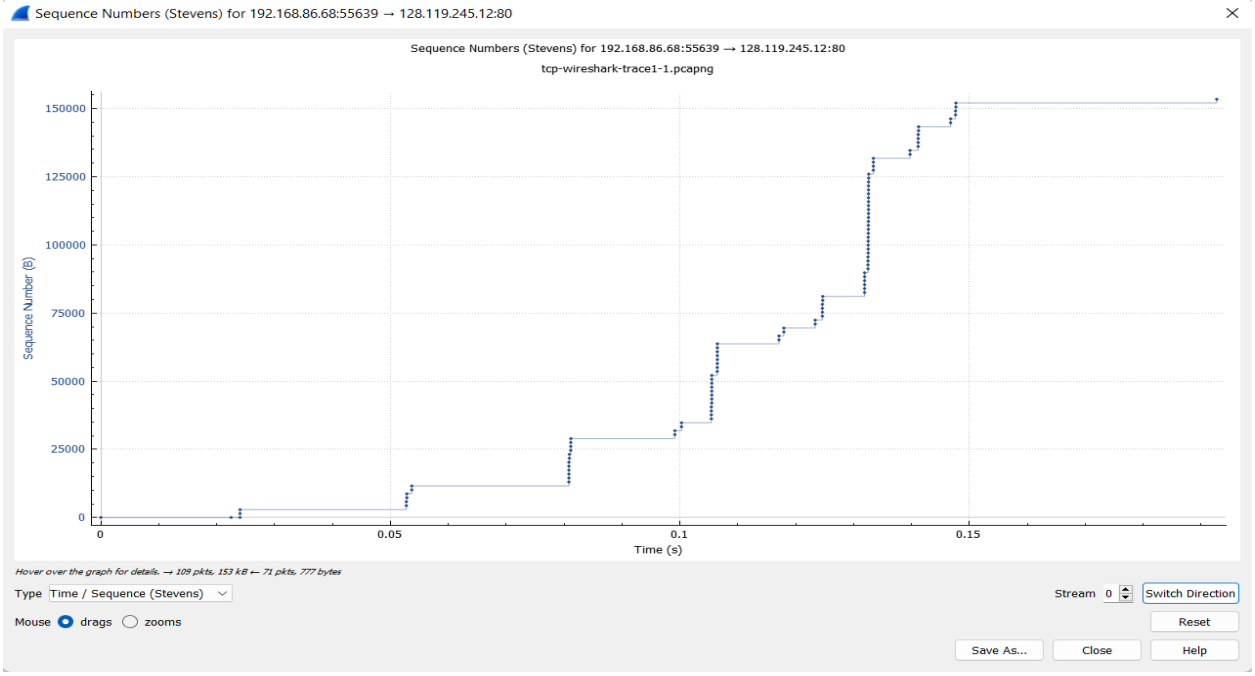
Ques6.)

1.) The time at which the first packet was sent is : 0.024047s
2.) The time at which the ack for first packet came : 0.052671s
3.) RTT for the first packet is : 0.028624s
4.) RTT for the second packet is : 0.028628s
5.) Estimated RTT = (1-0.125)*0.028624 + (0.125)*0.028628 = 0.0286245

Ques7.) The length of (header+payload) of the first 4 segments : 1480 bytes

Ques8.) The minimum amount of buffer space advertised : 31872. No, the lack of receiver buffer space never throttles the sender for these first four data carrying segments.

Ques9.) There are no retransmitted segments in the trace file. We can verify this by checking the sequence numbers of the TCP segments in the trace file.



Ques10.)

Acknowledgement Number	Packet Number	Data
4236650636	Ack1	1448
4236652084	Ack2	1448
4236653532	Ack3	1448
4236654980	Ack4	1448
4236656428	Ack5	1448
4236657876	Ack6	1448
4236659324	Ack7	1448
4236660772	Ack8	1448
4236662220	Ack9	1448
4236663668	Ack10	1448

The difference between consecutive acknowledgement numbers indicates the size of the packet.

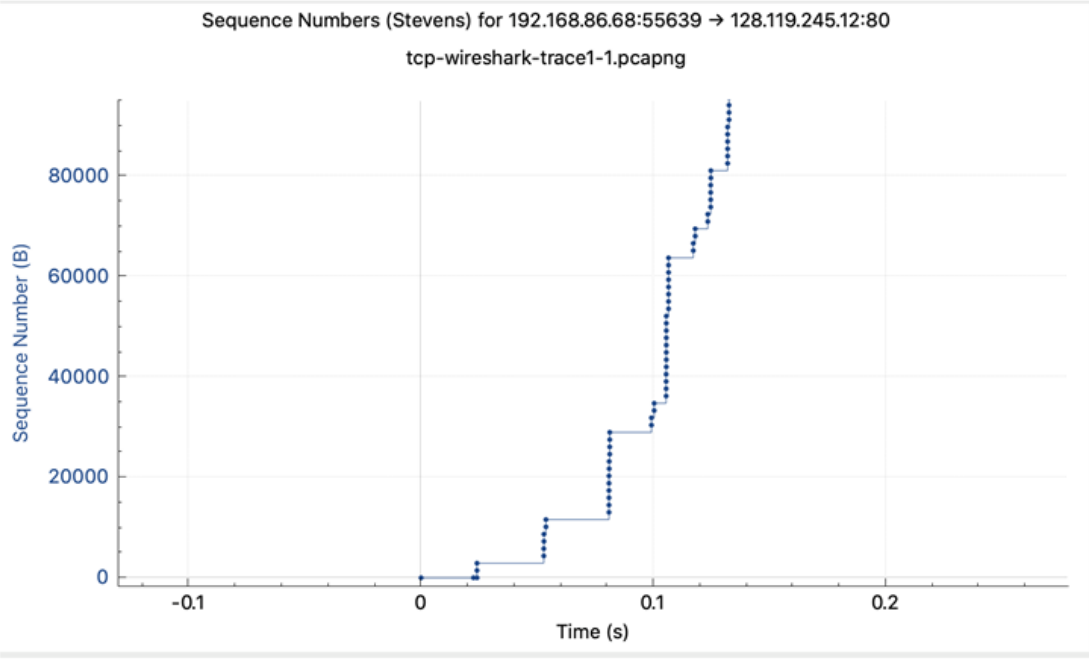
Ques11.) Throughput = Total data sent/ Total time

Total data sent = 150241 bytes

Total time = 0.191496

Throughput = 7,84,564.69 bytes/s

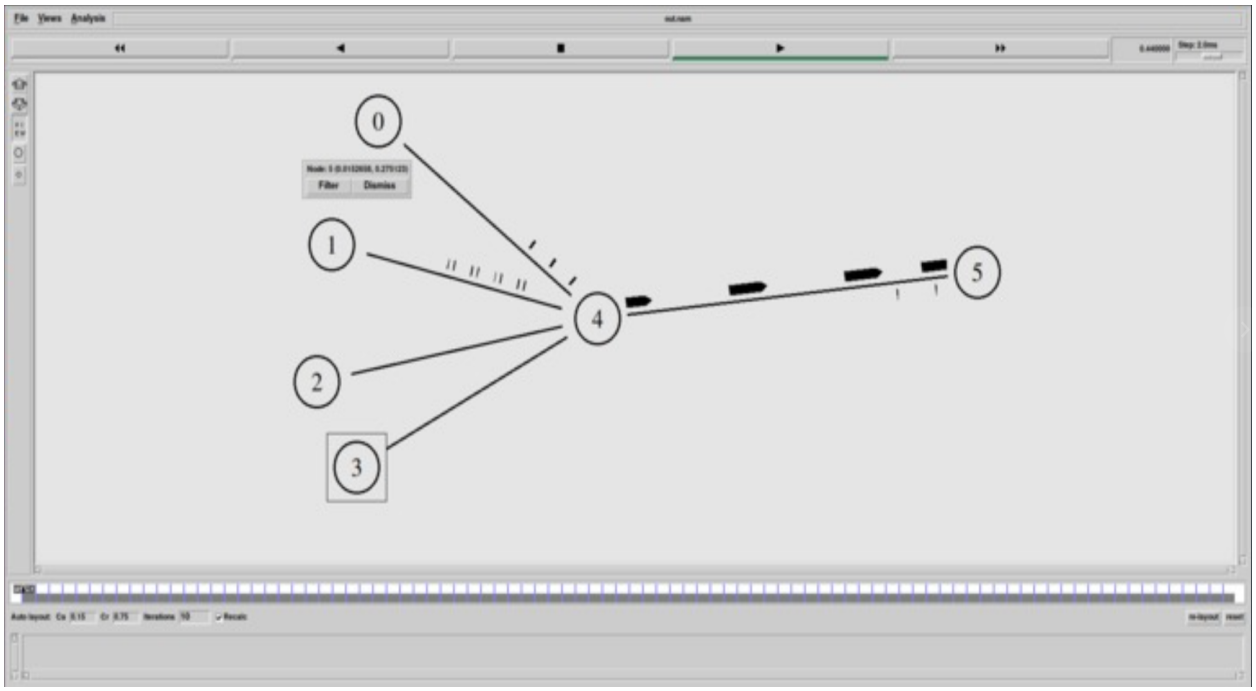
Ques12.)



Task 2 : NS2

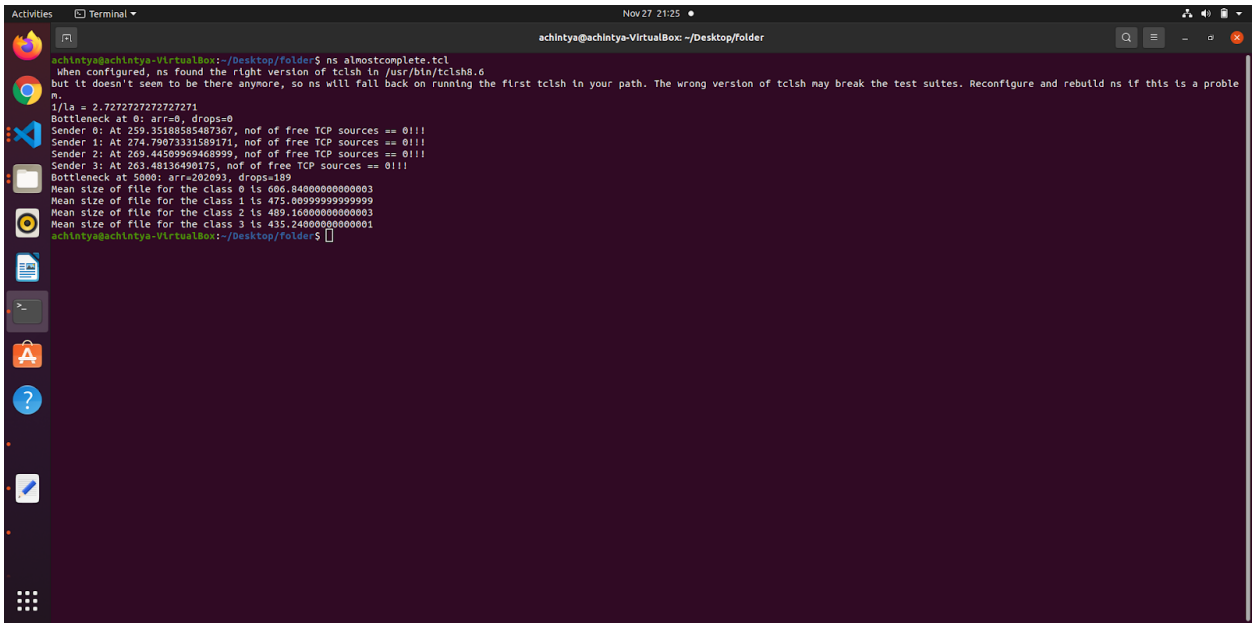
Github Link : https://github.com/akshatagarwal18/CSN-341

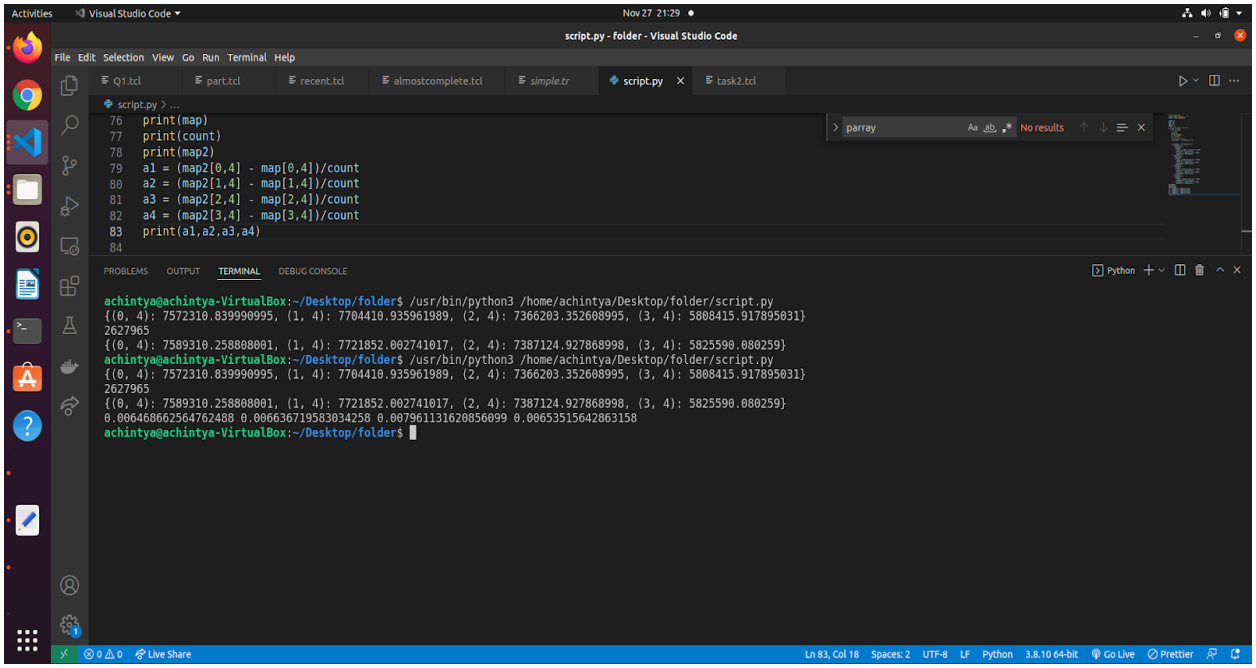
Ques1.)



Simulator for Task 1

1.) P = 0.1%


Activities
Terminal
Nov 27 21:25
achintya@achintya-VirtualBox: ~/Desktop/folder
achintya@achintya-VirtualBox:~/Desktop/folder$ ns almostcomplete.tcl
When configured, ns found the right version of tclsh in /usr/bin/tclsh8.6
but it doesn't seem to be there anymore, so ns will fall back on running the first tclsh in your path. The wrong version of tclsh may break the test suites. Reconfigure and rebuild ns if this is a proble
m.
1/la = 2.7272727272727271
Bottleneck at 0: arr=0, drops=0
Sender 0: At 259.35188585487367, nof of free TCP sources == 0!!!
Sender 1: At 274.79073331589171, nof of free TCP sources == 0!!!
Sender 2: At 269.44589969468999, nof of free TCP sources == 0!!!
Sender 3: At 263.48136490175, nof of free TCP sources == 0!!!
Bottleneck at 5000: arr=202093, drops=189
Mean size of file for the class 0 is 606.84000000000003
Mean size of file for the class 1 is 475.00999999999999
Mean size of file for the class 2 is 489.16000000000003
Mean size of file for the class 3 is 431.24000000000001
achintya@achintya-VirtualBox:~/Desktop/folder$


Activities
Visual Studio Code
Nov 27 21:29
script.py - folder - Visual Studio Code
File Edit Selection View Go Run Terminal Help
Q1.tcl
part.tcl
recent.tcl
almostcomplete.tcl
simple.tr
script.py
task2.tcl
76 print(map)
77 print(count)
78 print(map2)
79 a1 = (map2[0,4] - map[0,4])/count
80 a2 = (map2[1,4] - map[1,4])/count
81 a3 = (map2[2,4] - map[2,4])/count
82 a4 = (map2[3,4] - map[3,4])/count
83 print(a1,a2,a3,a4)
84
parray
No results
PROBLEMS
OUTPUT
TERMINAL
DEBUG CONSOLE
Python
achintya@achintya-VirtualBox:~/Desktop/folder$ /usr/bin/python3 /home/achintya/Desktop/folder/script.py
{(0, 4): 7572310.839990995, (1, 4): 7704410.935961989, (2, 4): 7366203.352608995, (3, 4): 5808415.917895031}
2627965
{(0, 4): 7589310.258808001, (1, 4): 7721852.002741017, (2, 4): 7387124.927868998, (3, 4): 5825590.080259}
achintya@achintya-VirtualBox:~/Desktop/folder$ /usr/bin/python3 /home/achintya/Desktop/folder/script.py
{(0, 4): 7572310.839990995, (1, 4): 7704410.935961989, (2, 4): 7366203.352608995, (3, 4): 5808415.917895031}
2627965
{(0, 4): 7589310.258808001, (1, 4): 7721852.002741017, (2, 4): 7387124.927868998, (3, 4): 5825590.080259}
0.006468662564762488 0.006636719583034258 0.007961131620856099 0.00653515642863158
achintya@achintya-VirtualBox:~/Desktop/folder$
Live Share
Ln 83, Col 18
Spaces: 2
UTF-8
LF
Python
3.8.10 64-bit
Go Live
Prettier

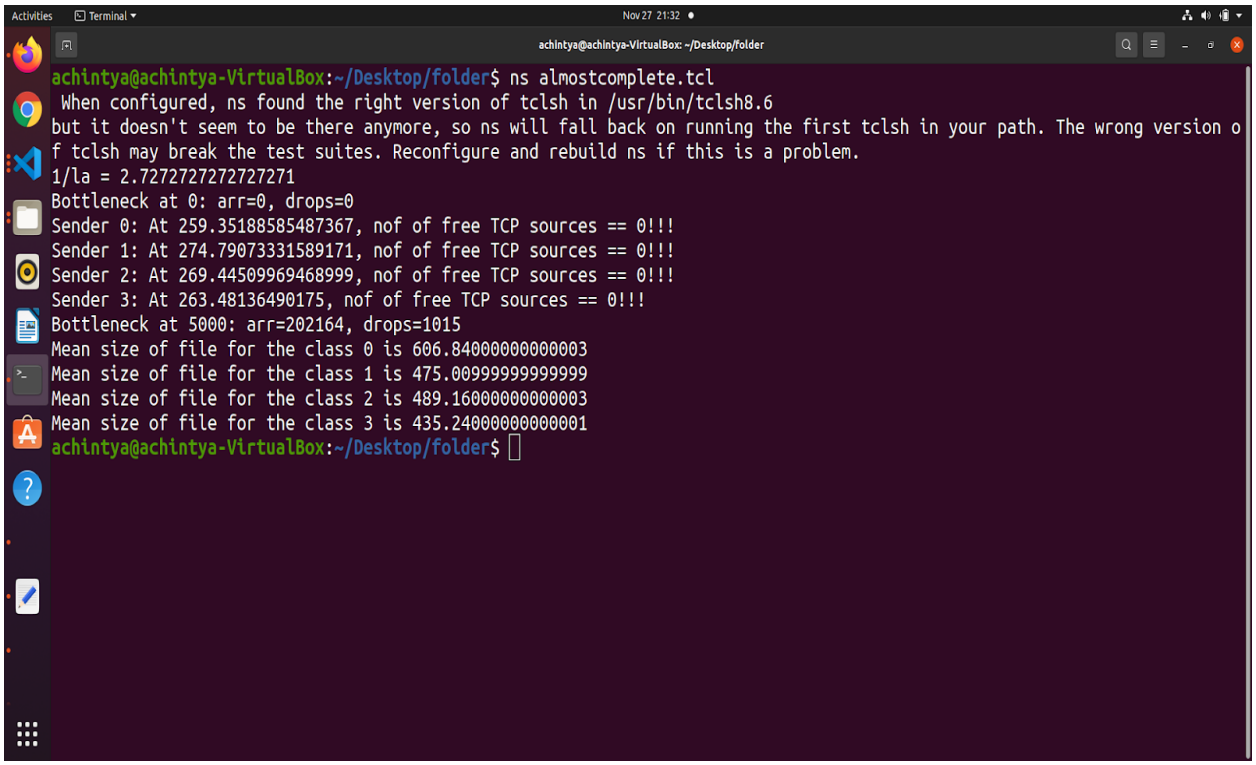
- Average Time Delay in every class :
    1.) 0.006468662564762488
    2.) 0.006636719583034258
    3.) 0.007961131620856099
    4.) 0.00653515642863158

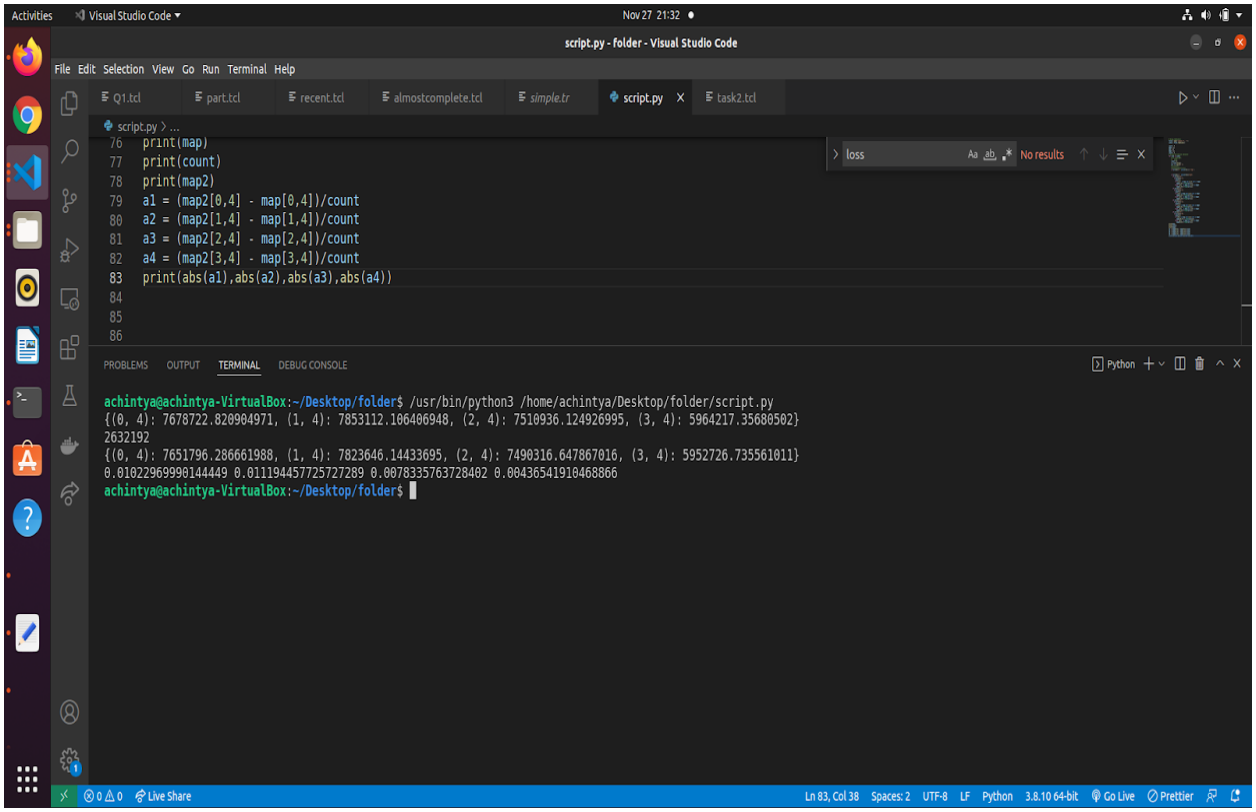
- Average Bandwidth in every class :
    1.) 0.7504982600956Mbps
    2.) 0.5725840835153Mbps
    3.) 0.4915482102755Mbps
    4.) 0.5327982639780Mbps

- Wi/W1 for each class :
    1.) 1
    2.) 1.025980180074200640349800583931 2
    3.) 1.230722972662651243840704438140 2
    4.) 1.010279383597980810266167225590 6

- Confidence Interval : A confidence interval (CI) is a range of estimates for an unknown parameter. A confidence interval is computed at a designated *confidence level*; the 95% confidence level is most common, but other levels, such as 90% or 99%, are sometimes used. The confidence level represents the long-run proportion of corresponding CIs that contain the true value of the parameter.

2.) P = 0.5


Activities
Terminal
Nov 27 21:32
achintya@achintya-VirtualBox: ~/Desktop/folder
achintya@achintya-VirtualBox:~/Desktop/folder$ ns almostcomplete.tcl
When configured, ns found the right version of tclsh in /usr/bin/tclsh8.6
but it doesn't seem to be there anymore, so ns will fall back on running the first tclsh in your path. The wrong version of tclsh may break the test suites. Reconfigure and rebuild ns if this is a problem.
1/la = 2.7272727272727271
Bottleneck at 0: arr=0, drops=0
Sender 0: At 259.35188585487367, nof of free TCP sources == 0!!!
Sender 1: At 274.79073331589171, nof of free TCP sources == 0!!!
Sender 2: At 269.44509969468999, nof of free TCP sources == 0!!!
Sender 3: At 263.48136490175, nof of free TCP sources == 0!!!
Bottleneck at 5000: arr=202164, drops=1015
Mean size of file for the class 0 is 606.84000000000003
Mean size of file for the class 1 is 475.00999999999999
Mean size of file for the class 2 is 489.16000000000003
Mean size of file for the class 3 is 435.24000000000001
achintya@achintya-VirtualBox:~/Desktop/folder$


Activities
Visual Studio Code
Nov 27 21:32
script.py - folder - Visual Studio Code
File Edit Selection View Go Run Terminal Help
Q1.tcl
part.tcl
recent.tcl
almostcomplete.tcl
simple.tr
script.py
task2.tcl
print(map)
print(count)
print(map2)
a1 = (map2[0,4] - map[0,4])/count
a2 = (map2[1,4] - map[1,4])/count
a3 = (map2[2,4] - map[2,4])/count
a4 = (map2[3,4] - map[3,4])/count
print(abs(a1),abs(a2),abs(a3),abs(a4))
loss
No results
PROBLEMS
OUTPUT
TERMINAL
DEBUG CONSOLE
Python
achintya@achintya-VirtualBox:~/Desktop/folder$ /usr/bin/python3 /home/achintya/Desktop/folder/script.py
{(0, 4): 7678722.820904971, (1, 4): 7853112.106406948, (2, 4): 7510936.124926995, (3, 4): 5964217.35680502}
2632192
{(0, 4): 7651796.286661988, (1, 4): 7823646.14433695, (2, 4): 7490316.647867016, (3, 4): 5952726.735561011}
0.01022969990144449 0.011194457725727289 0.0078335763728402 0.00436541910468866
achintya@achintya-VirtualBox:~/Desktop/folder$
Live Share
Ln 83, Col 38
Spaces: 2
UTF-8
LF
Python
3.8.10 64-bit
Go Live
Prettier

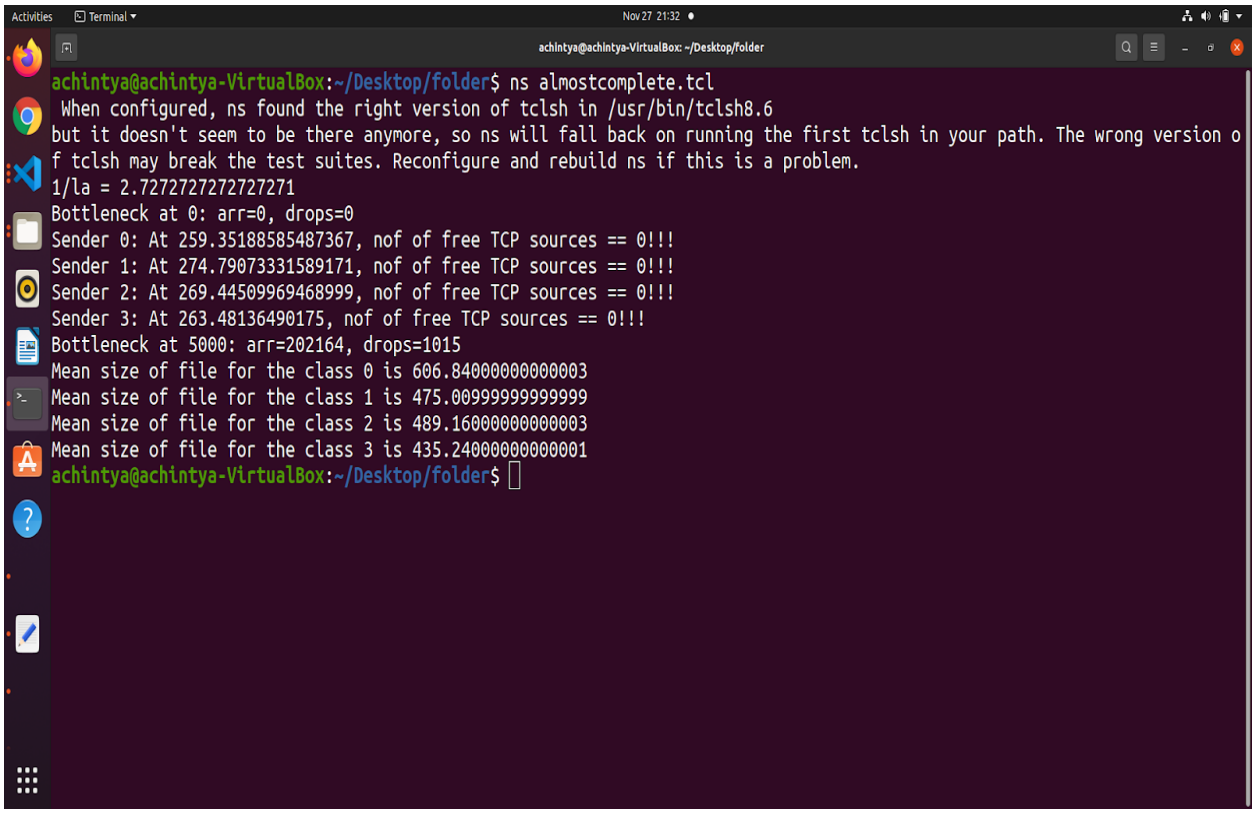
- Average Time Delay in every class :
    1.) 0.01022969990144449
    2.) 0.011194457725727289
    3.) 0.0078335763728402
    4.) 0.00436541910468866

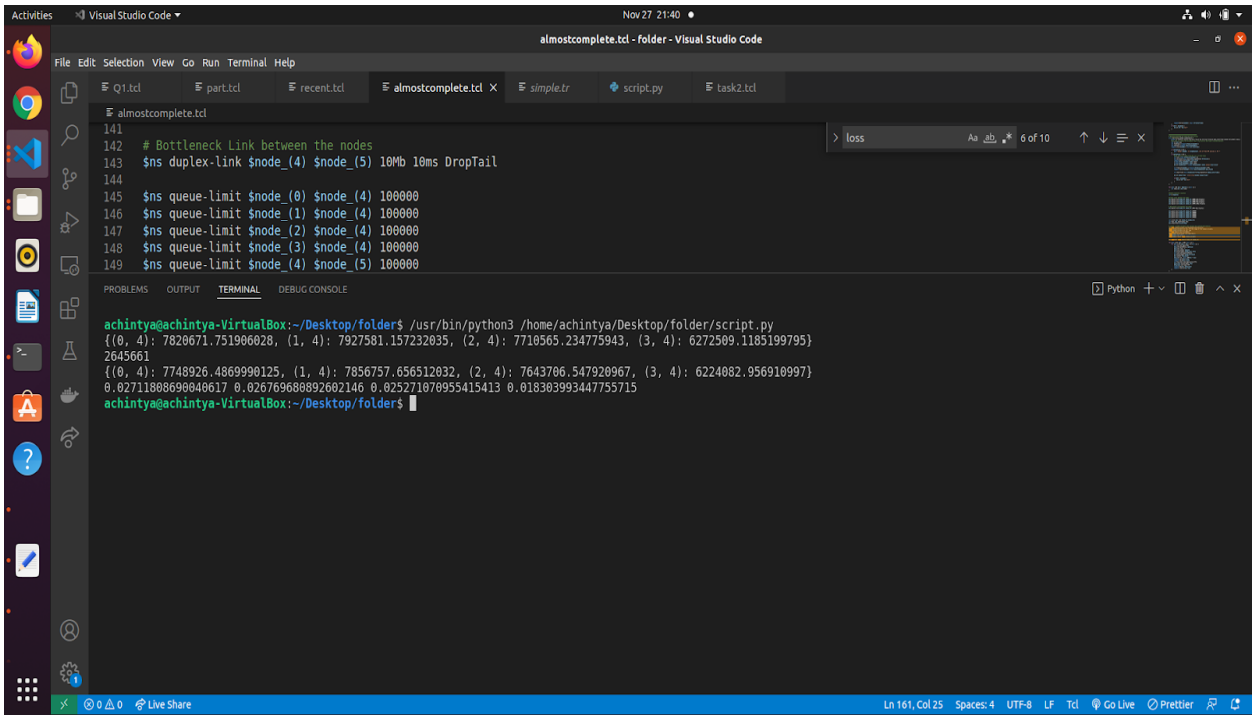
- Average Bandwidth in every class :
    1.) 0.474571106363979141261836602874 22 Mbps
    2.) 0.339460837952569407432043676616 61Mbps
    3.) 0.499552160309272914421028752728 1Mbps
    4.) 0.797614138871628286878149068538 67Mbps

- Wi/W1 for each class :
    1.) 1
    2.) 1.094309494274271904947647288853 7
    3.) 0.765767954906874232626958024419 92
    4.) 0.426739703681066808756504753909 67

- Confidence Interval : A confidence interval (CI) is a range of estimates for an unknown parameter. A confidence interval is computed at a designated *confidence level*; the 95% confidence level is most common, but other levels, such as 90% or 99%, are sometimes used. The confidence level represents the long-run proportion of corresponding CIs that contain the true value of the parameter.

3.) P = 1%


Activities
Terminal
Nov 27 21:32
achintya@achintya-VirtualBox: ~/Desktop/folder
achintya@achintya-VirtualBox:~/Desktop/folder$ ns almostcomplete.tcl
When configured, ns found the right version of tclsh in /usr/bin/tclsh8.6
but it doesn't seem to be there anymore, so ns will fall back on running the first tclsh in your path. The wrong version of tclsh may break the test suites. Reconfigure and rebuild ns if this is a problem.
1/la = 2.7272727272727271
Bottleneck at 0: arr=0, drops=0
Sender 0: At 259.35188585487367, nof of free TCP sources == 0!!!
Sender 1: At 274.79073331589171, nof of free TCP sources == 0!!!
Sender 2: At 269.44509969468999, nof of free TCP sources == 0!!!
Sender 3: At 263.48136490175, nof of free TCP sources == 0!!!
Bottleneck at 5000: arr=202164, drops=1015
Mean size of file for the class 0 is 606.84000000000003
Mean size of file for the class 1 is 475.00999999999999
Mean size of file for the class 2 is 489.16000000000003
Mean size of file for the class 3 is 435.24000000000001
achintya@achintya-VirtualBox:~/Desktop/folder$


Activities
Visual Studio Code
Nov 27 21:40
almostcomplete.tcl - folder - Visual Studio Code
File Edit Selection View Go Run Terminal Help
Q1.tcl
part.tcl
recent.tcl
almostcomplete.tcl
simple.tr
script.py
task2.tcl
Bottleneck Link between the nodes
$ns duplex-link $node_(4) $node_(5) 10Mb 10ms DropTail
$ns queue-limit $node_(0) $node_(4) 100000
$ns queue-limit $node_(1) $node_(4) 100000
$ns queue-limit $node_(2) $node_(4) 100000
$ns queue-limit $node_(3) $node_(4) 100000
$ns queue-limit $node_(4) $node_(5) 100000
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
achintya@achintya-VirtualBox:~/Desktop/folder$ /usr/bin/python3 /home/achintya/Desktop/folder/script.py
{(0, 4): 7820671.751906028, (1, 4): 7927581.157232035, (2, 4): 7710565.234775943, (3, 4): 6272509.1185199795}
2645661
{(0, 4): 7748926.4869990125, (1, 4): 7856757.656512032, (2, 4): 7643706.547920967, (3, 4): 6224082.956910997}
0.027118086900040617 0.026769688892602146 0.025271070955415413 0.018303993447755715
achintya@achintya-VirtualBox:~/Desktop/folder$
Live Share
Ln 161, Col 25
Spaces: 4
UTF-8
LF
Tcl
Go Live
Prettier

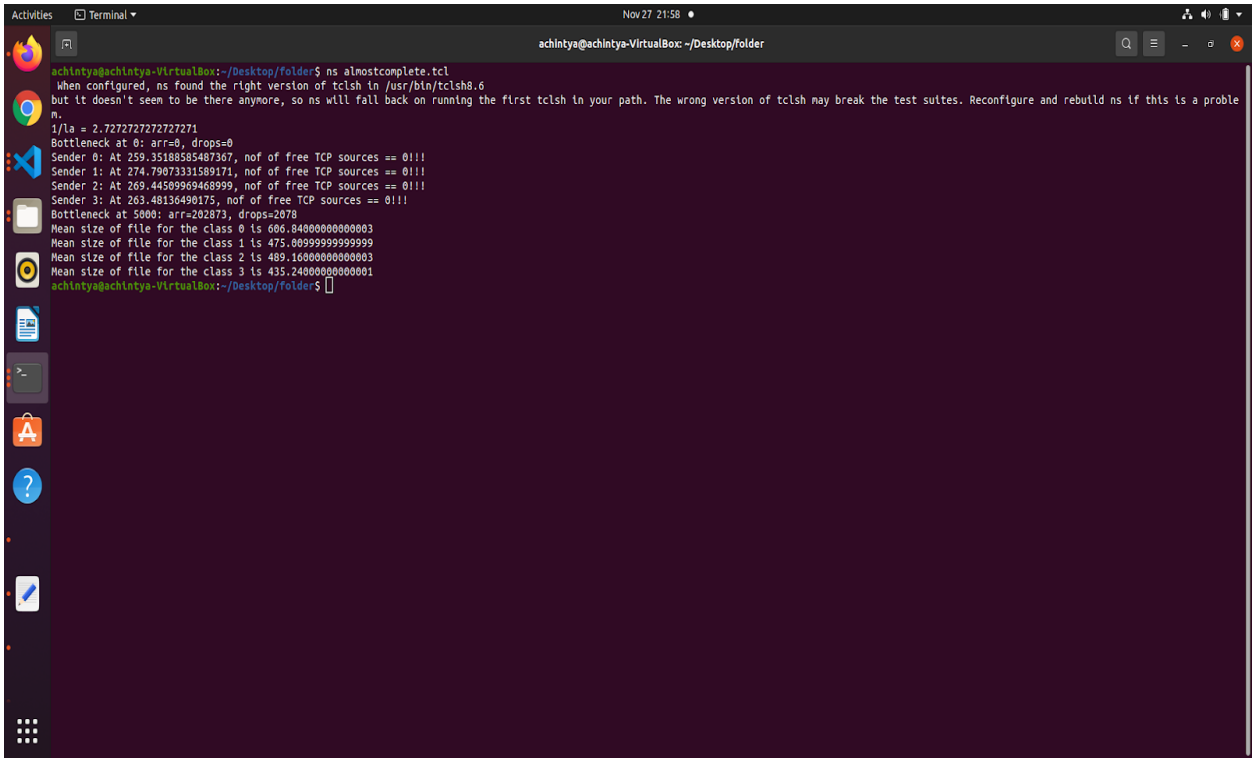
- Average Time Delay in every class :
  1.) 0.02711808690040617
  2.) 0.026769680892602146
  3.) 0.025271070955415413
  4.) 0.018303993447755715

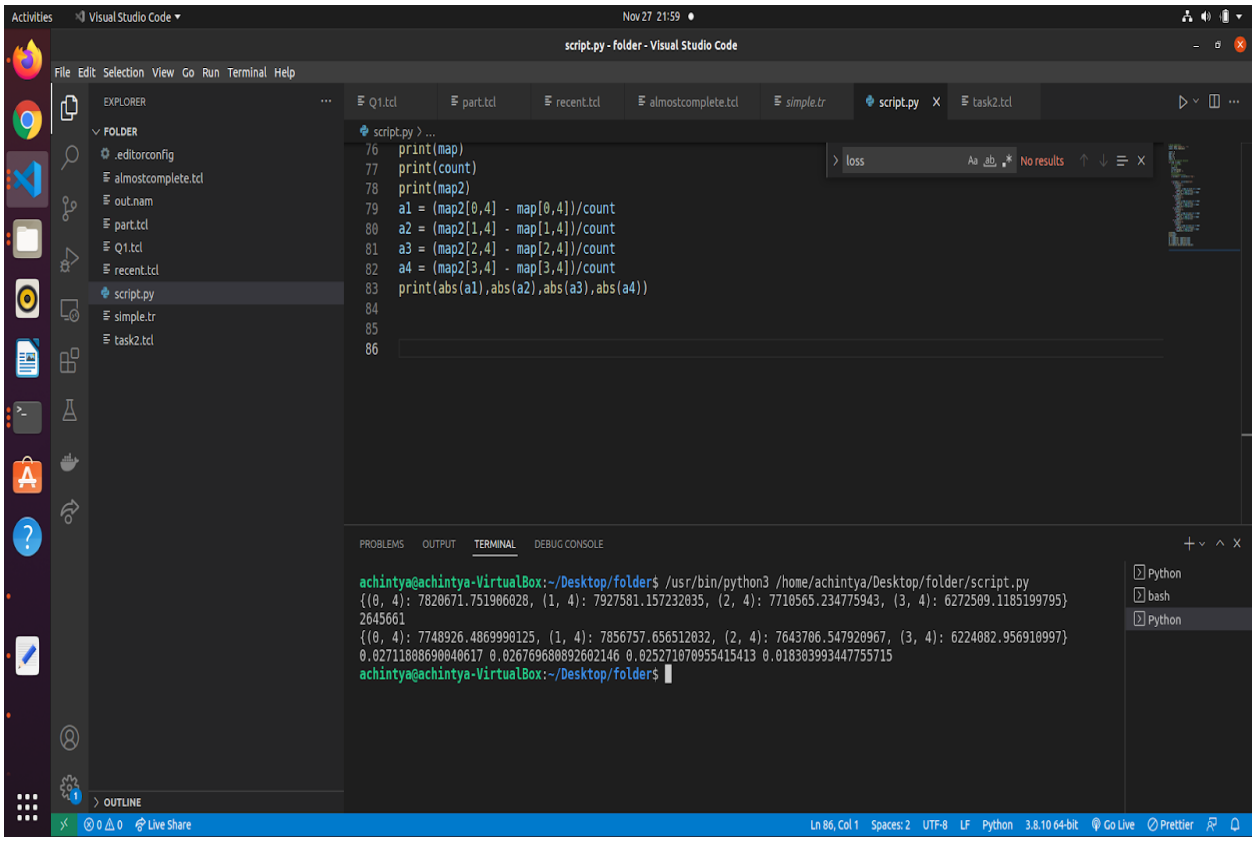
- Average Bandwidth in every class :
  1.) 0.17902147809428581948 Mbps
  2.) 0.14195462453383815968Mbps
  3.) 0.15485216304857122895Mbps
  4.) 0.190227340822552820 91Mbps

- Wi/W1 for each class :
  1.) 1
  2.) 0.98715226449846631197013598839331
  3.) 0.93188988766891617580610069941449
  4.) 0.67497362608870321756700143232157

- Confidence Interval : A confidence interval (CI) is a range of estimates for an unknown parameter. A confidence interval is computed at a designated *confidence level*; the 95% confidence level is most common, but other levels, such as 90% or 99%, are sometimes used. The confidence level represents the long-run proportion of corresponding CIs that contain the true value of the parameter.

4.) P = 5


Activities
Terminal
Nov 27 21:58
achintya@achintya-VirtualBox: ~/Desktop/folder
achintya@achintya-VirtualBox:~/Desktop/folder$ ns almostcomplete.tcl
When configured, ns found the right version of tclsh in /usr/bin/tclsh8.6
but it doesn't seem to be there anymore, so ns will fall back on running the first tclsh in your path. The wrong version of tclsh may break the test suites. Reconfigure and rebuild ns if this is a proble
m.
1/la = 2.7272727272727271
Bottleneck at 0: arr=0, drops=0
Sender 0: At 259.35188585487367, nof of free TCP sources == 0!!!
Sender 1: At 274.79073331589171, nof of free TCP sources == 0!!!
Sender 2: At 269.44509969468999, nof of free TCP sources == 0!!!
Sender 3: At 263.48136490175, nof of free TCP sources == 0!!!
Bottleneck at 5000: arr=202873, drops=2078
Mean size of file for the class 0 is 666.84000000000003
Mean size of file for the class 1 is 475.00999999999999
Mean size of file for the class 2 is 489.16000000000003
Mean size of file for the class 3 is 435.24000000000001
achintya@achintya-VirtualBox:~/Desktop/folder$


Activities
Visual Studio Code
Nov 27 21:59
script.py - folder - Visual Studio Code
File Edit Selection View Go Run Terminal Help
EXPLORER
FOLDER
.editorconfig
almostcomplete.tcl
out.nam
part.tcl
Q1.tcl
recent.tcl
script.py
simple.tr
task2.tcl
Q1.tcl
part.tcl
recent.tcl
almostcomplete.tcl
simple.tr
script.py
task2.tcl
print(map)
print(count)
print(map2)
a1 = (map2[0,4] - map[0,4])/count
a2 = (map2[1,4] - map[1,4])/count
a3 = (map2[2,4] - map[2,4])/count
a4 = (map2[3,4] - map[3,4])/count
print(abs(a1),abs(a2),abs(a3),abs(a4))
loss
No results
PROBLEMS
OUTPUT
TERMINAL
DEBUG CONSOLE
achintya@achintya-VirtualBox:~/Desktop/folder$ /usr/bin/python3 /home/achintya/Desktop/folder/script.py
{(0, 4): 7820671.751906028, (1, 4): 7927581.157232035, (2, 4): 7710565.234775943, (3, 4): 6272509.1185199795}
2645661
{(0, 4): 7748926.4869990125, (1, 4): 7856757.656512032, (2, 4): 7643706.547920967, (3, 4): 6224082.956910997}
0.02711808690040617 0.026769680892602146 0.025271070955415413 0.018303993447755715
achintya@achintya-VirtualBox:~/Desktop/folder$
Python
bash
Python
OUTLINE
Live Share
Ln 86, Col 1
Spaces: 2
UTF-8
LF
Python
3.8.10 64-bit
Go Live
Prettier

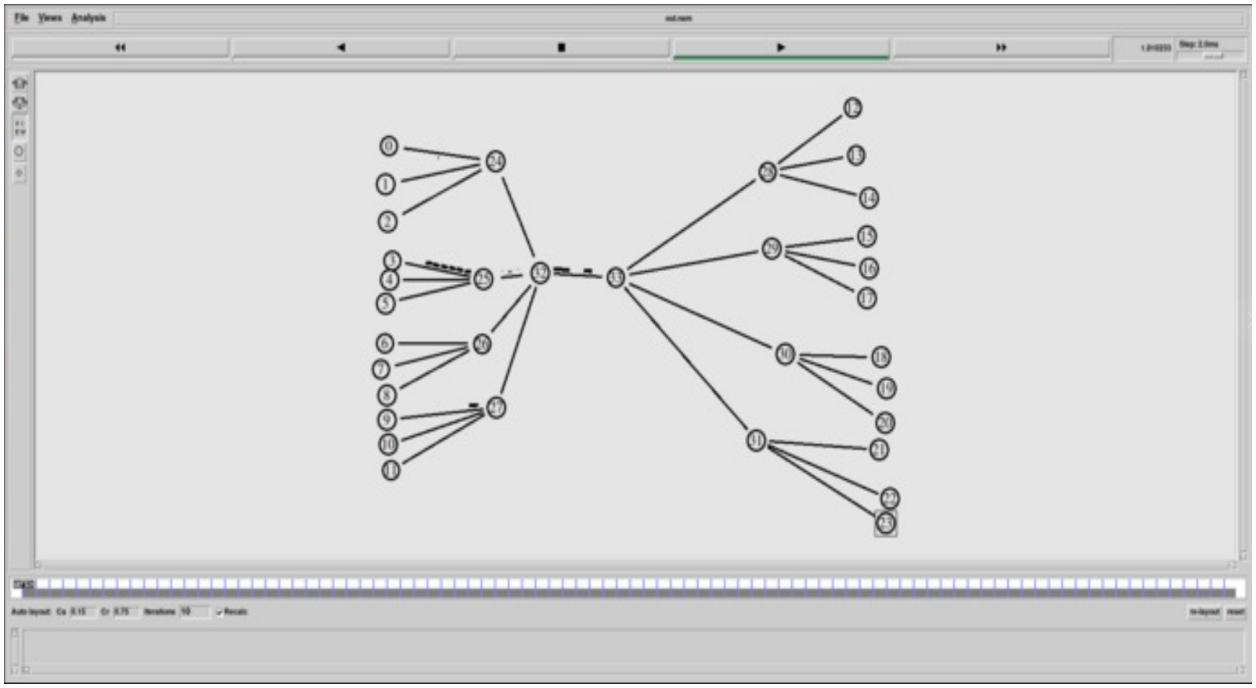
- Average Time Delay in every class :
  1.) 0.02711808690040617
  2.) 0.026769680892602146
  3.) 0.025271070955415413
  4.) 0.018303993447755715

- Average Bandwidth in every class :
  1.) 0.17902147809428581948 Mbps
  2.) 0.14195462453383815968Mbps
  3.) 0.15485216304857122895Mbps
  4.) 0.19022734082255282091Mbps

- Wi/W1 for each class :
  1.) 1
  2.) 0.98715226449846631197013598839331
  3.) 0.93188988766891617580610069941449
  4.) 0.67497362608870321756700143232157

- Confidence Interval : A confidence interval (CI) is a range of estimates for an unknown parameter. A confidence interval is computed at a designated *confidence level*; the 95% confidence level is most common, but other levels, such as 90% or 99%, are sometimes used. The confidence level represents the long-run proportion of corresponding CIs that contain the true value of the parameter.

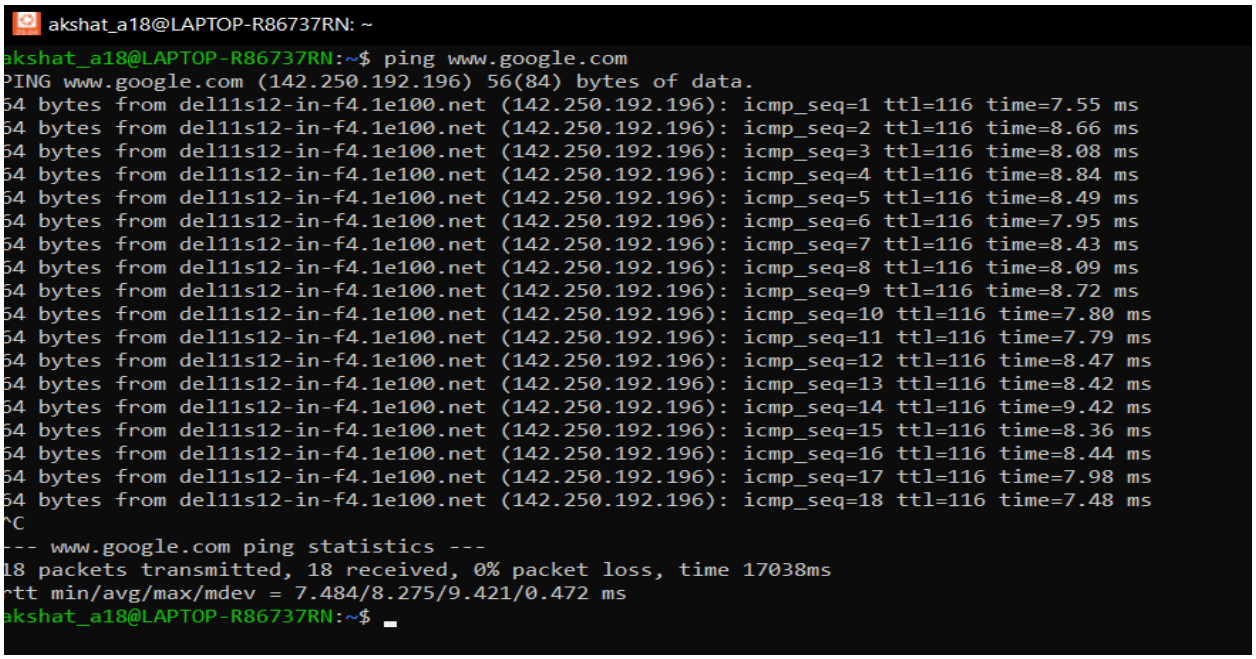
Ques2.)



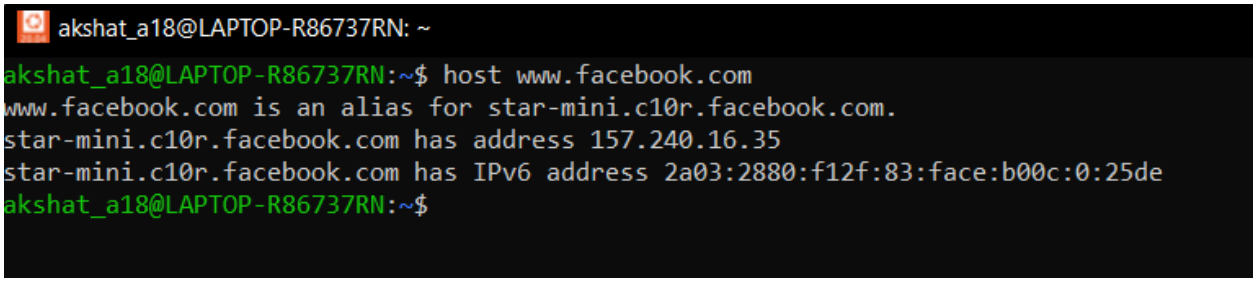
Simulator for Task 2

Task 3 : Networking Tools

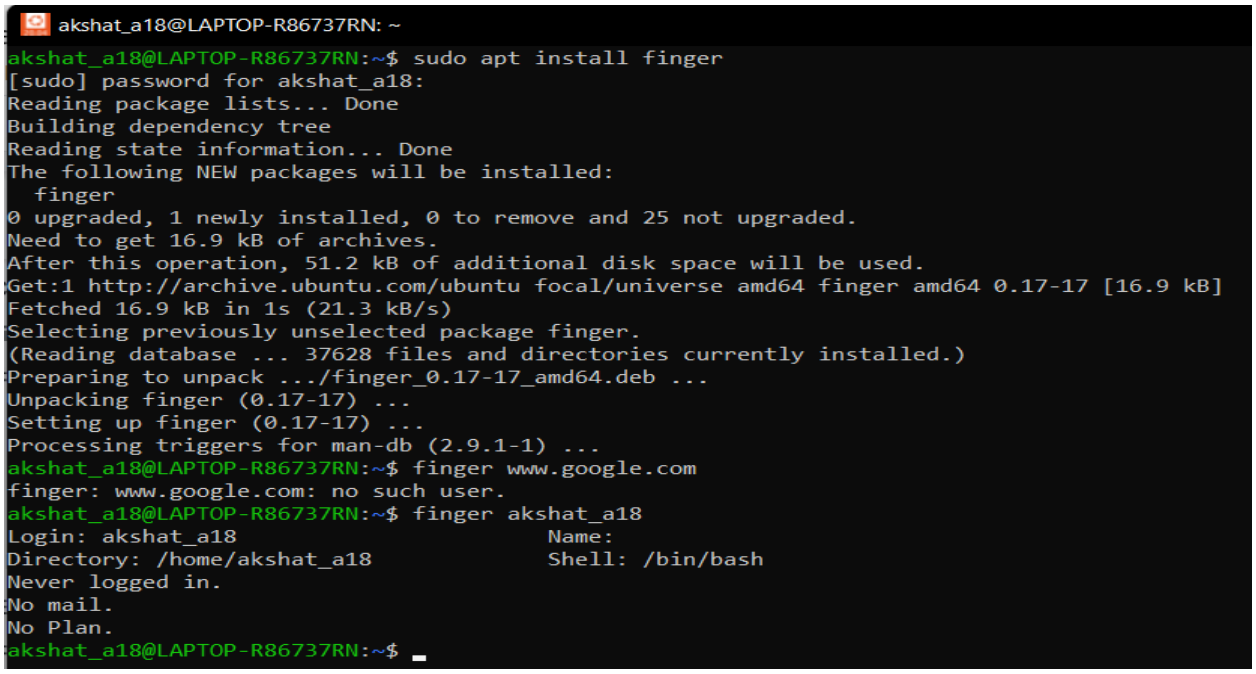
ping : The ping command is used to check if a remote system is running or up. In short this command is used to detect whether a system is connected to the network or not.



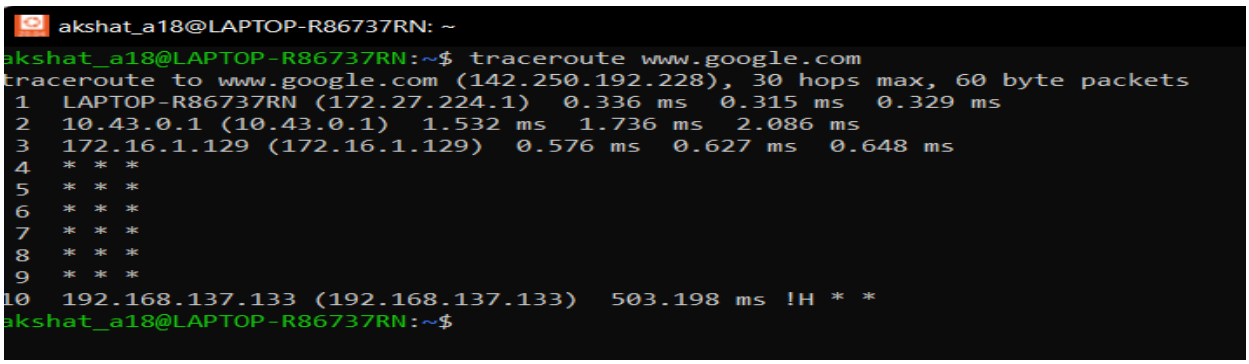
host : This command is used to obtain network address information about a remote system connected to your network. This information usually consists of system's IP address, domain name address and sometimes mail server also.



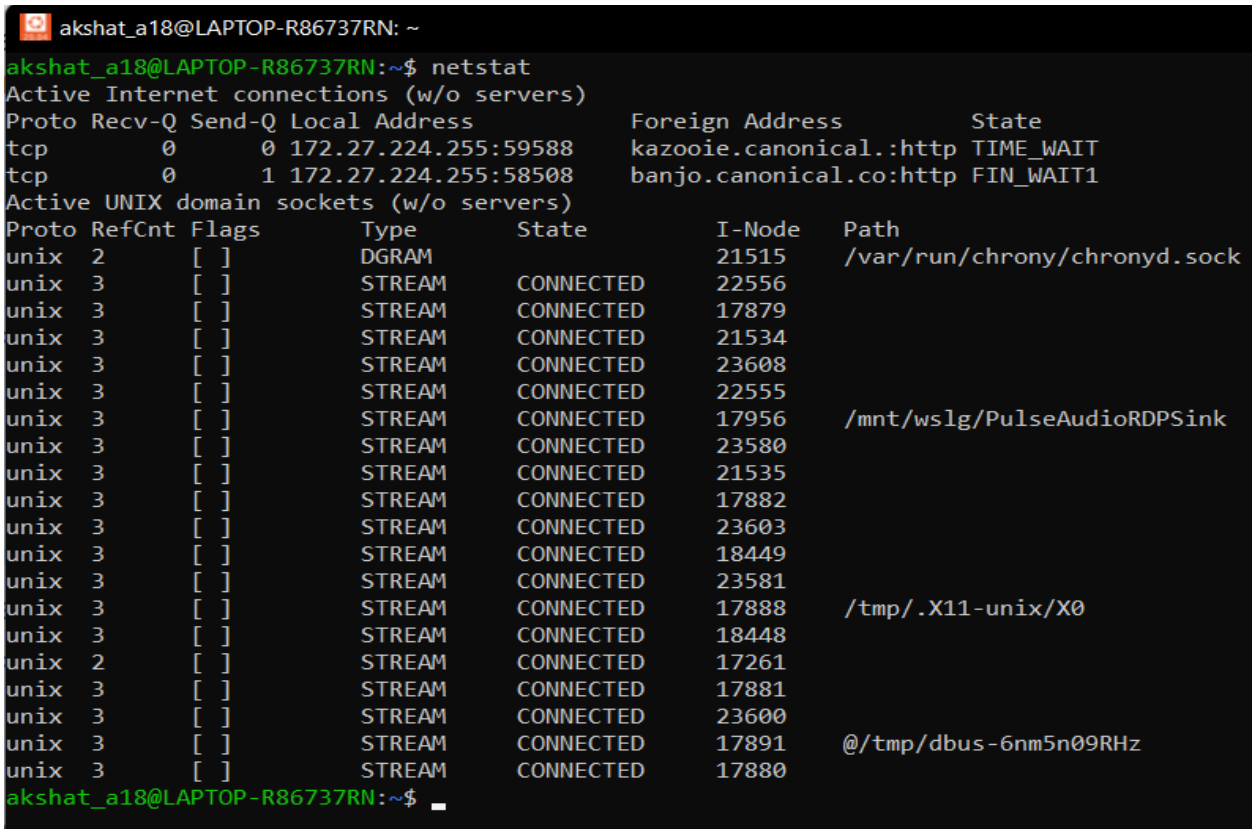
finger : One can obtain information about the user on its network and the who command to see what users are currently online on your system. The who command lists all users currently connected, along with when, how long, and where they logged in. finger can operate on large networks, though most systems block it for security reasons.



traceroute : This command is used to track the sequence of computer networks. Mtr or xmtr tools can also be used to perform both ping and traces. Options are available for specifying parameters like the type of service.



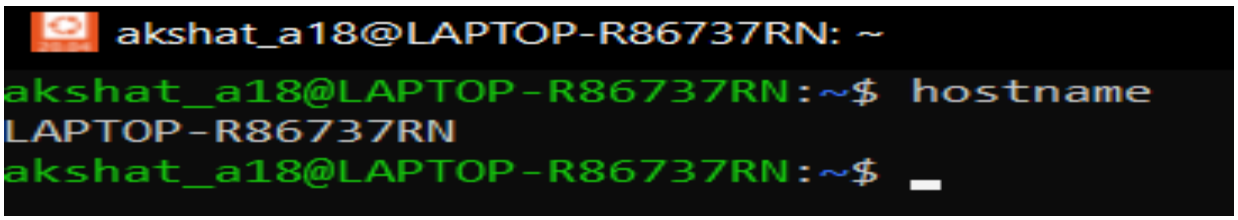
netstat : This command is used to check the status of ports whether they are open, closed, waiting, and masquerade connections. Network Statistic (netstat) command displays the connection information, routing table information etc.



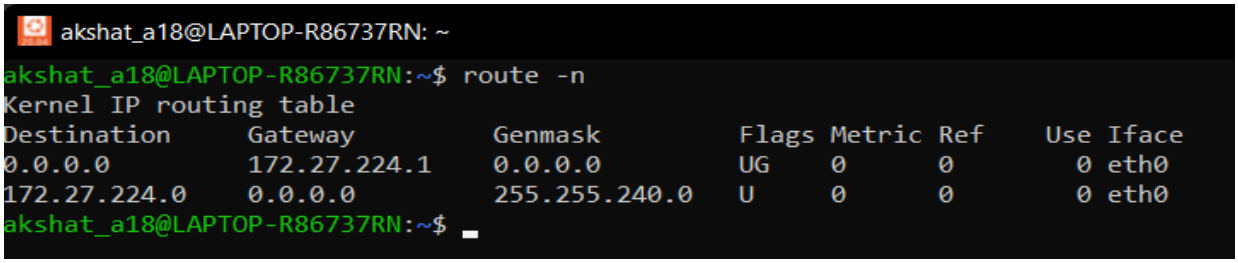
tracepath : tracepath performs a very similar function to that of traceroute command. The main difference between this command is that tracepath doesn't take complicated options. This command does not require root privileges.

dig : dig(Domain Information Groper) query DNS - related information like a record, cname, mxrecord etc. this command is used to solve DNS related queries.

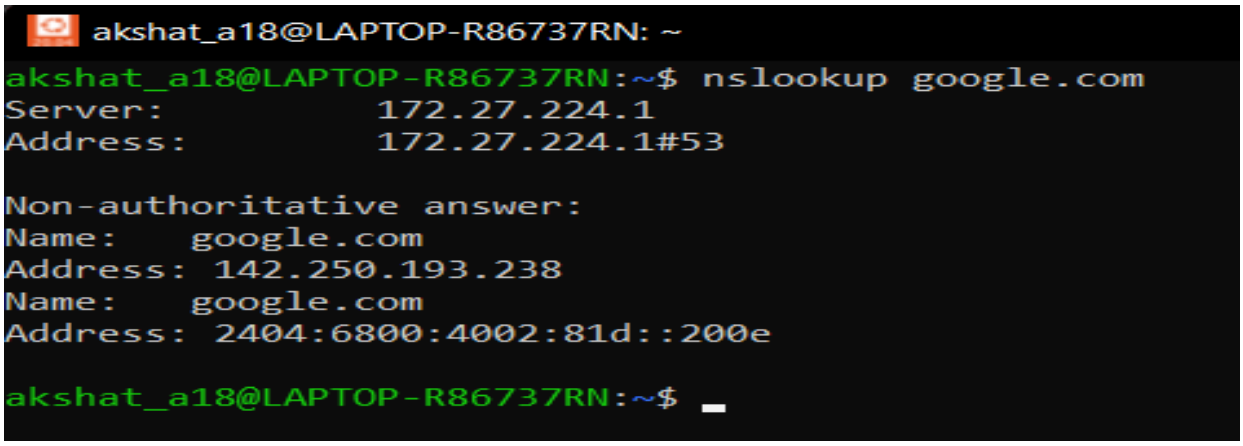
hostname : This command is used to see the hostname of your computer. You can change hostname permanently in etc/sysconfig/network. After changing the hostname you need to reboot the computer .



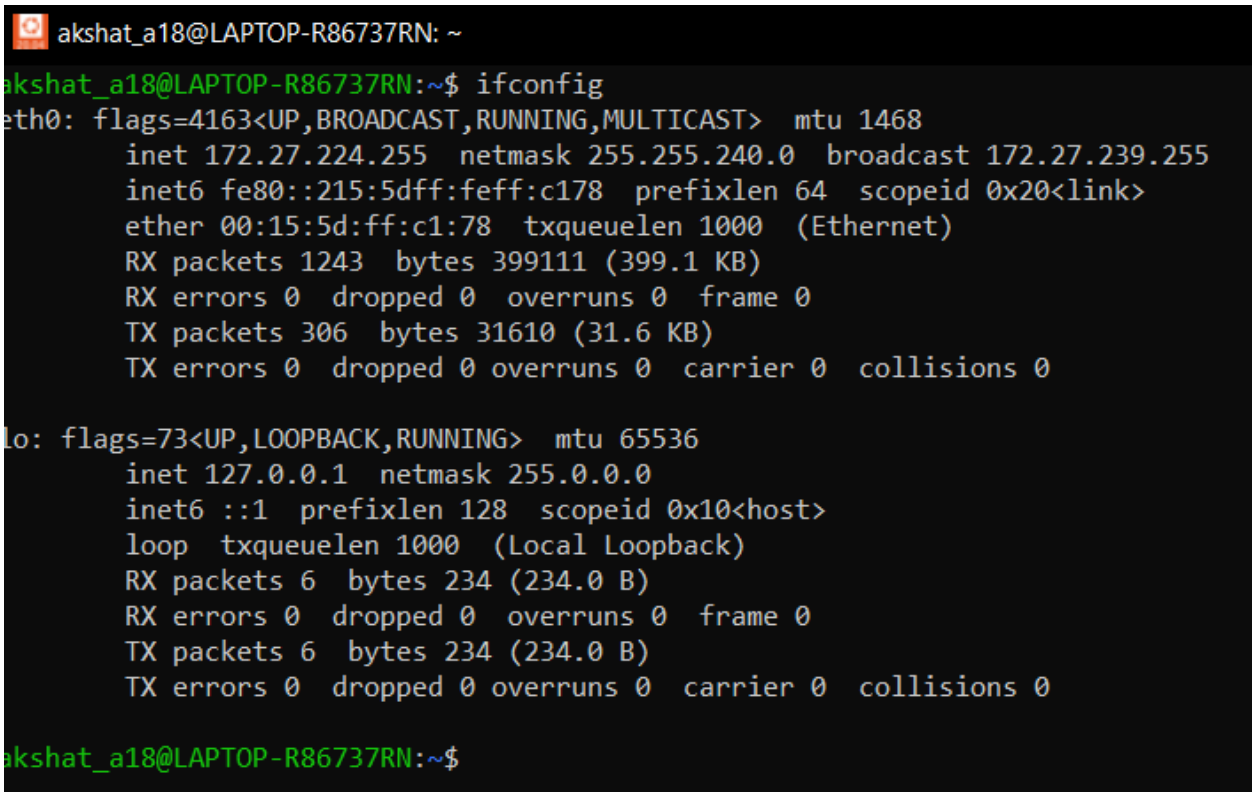
route : The route command is used to display or modify the routing table.



nslookup : We can use the nslookup command to find out DNS related queries or testing and for troubleshooting DNS servers.



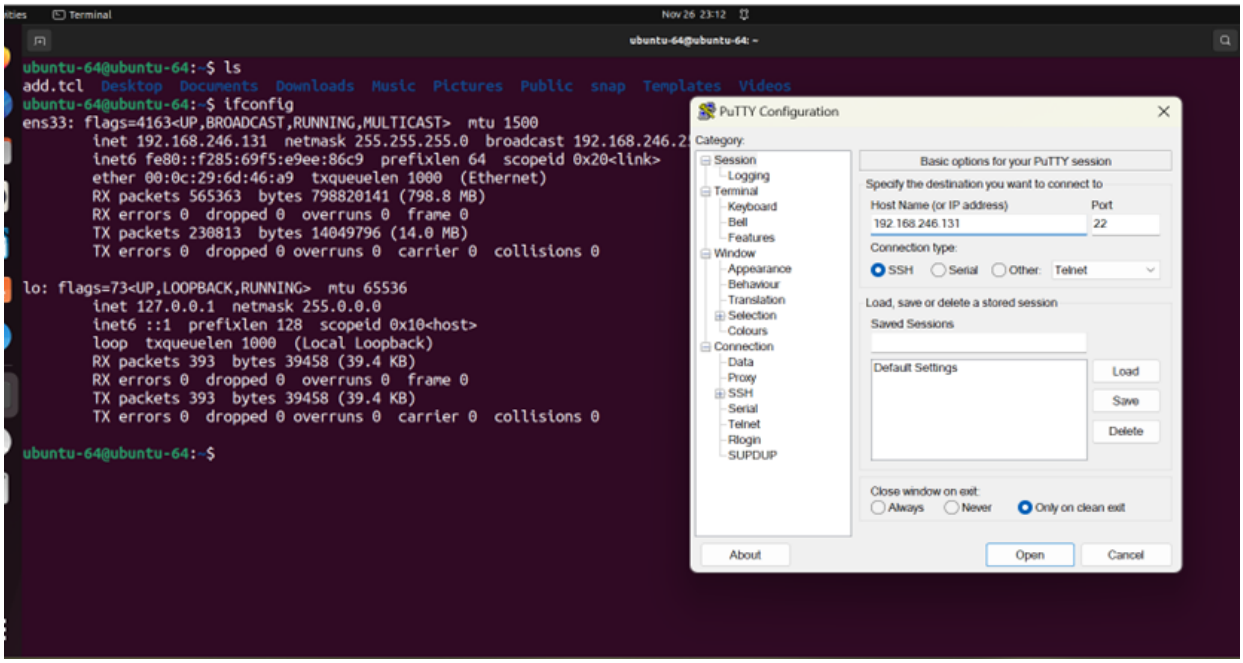
ifconfig : Not only will it provide IPv4 information, but it will also provide IPv6 addresses, MAC addresses, DNS servers, default gateways and data with regard to how much traffic is flowing over the interface along with errors and dropped packets.

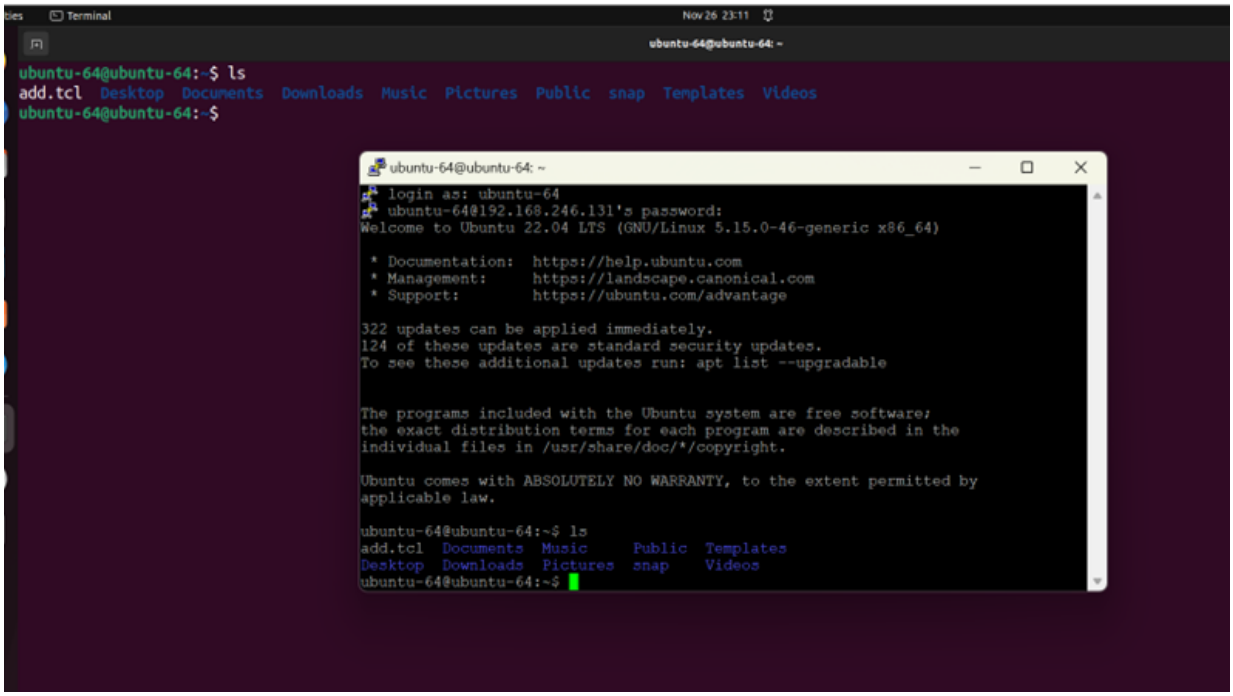


whois : whois is a query and response protocol that is widely used for querying databases that store the registered users or assignees of an Internet resource.

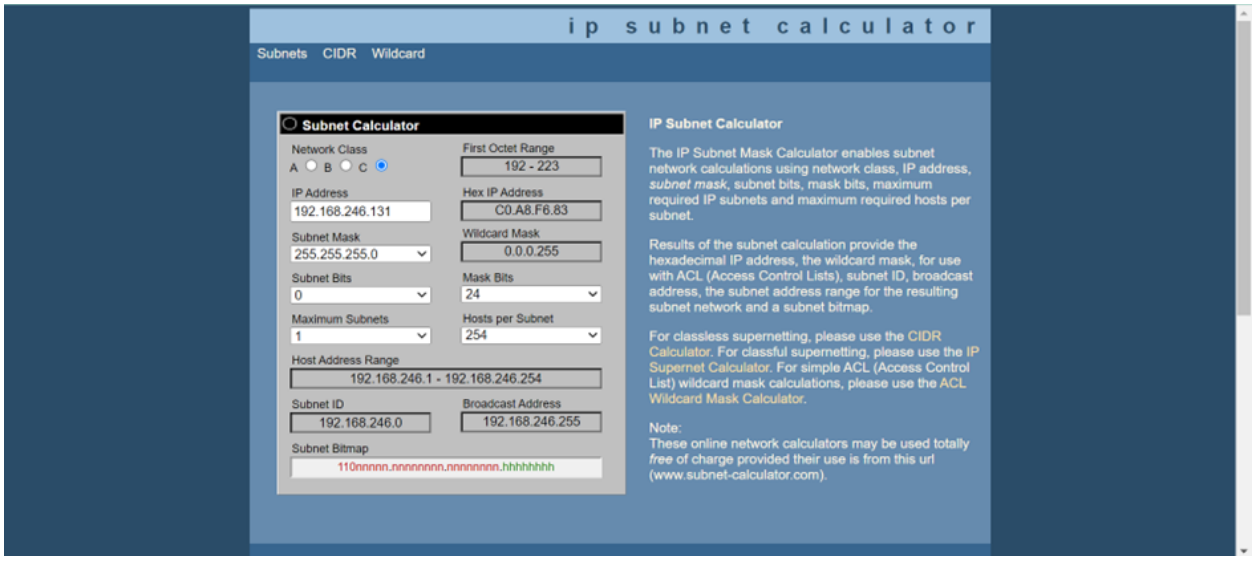
```
akshat_a18@LAPTOP-R86737RN:~$ whois www.google.com
No match for "WWW.GOOGLE.COM".
>>> Last update of whois database: 2022-11-27T11:05:39Z <<<

NOTICE: The expiration date displayed in this record is the date the
registrar's sponsorship of the domain name registration in the registry is
currently set to expire. This date does not necessarily reflect the expiration
date of the domain name registrant's agreement with the sponsoring
registrar.  Users may consult the sponsoring registrar's Whois database to
view the registrar's reported date of expiration for this registration.

TERMS OF USE: You are not authorized to access or query our Whois
database through the use of electronic processes that are high-volume and
automated except as reasonably necessary to register domain names or
modify existing registrations; the Data in VeriSign Global Registry
Services' ("VeriSign") Whois database is provided by VeriSign for
information purposes only, and to assist persons in obtaining information
about or related to a domain name registration record. VeriSign does not
guarantee its accuracy. By submitting a Whois query, you agree to abide
by the following terms of use: You agree that you may use this Data only
for lawful purposes and that under no circumstances will you use this Data
to: (1) allow, enable, or otherwise support the transmission of mass
unsolicited, commercial advertising or solicitations via e-mail, telephone,
or facsimile; or (2) enable high volume, automated, electronic processes
that apply to VeriSign (or its computer systems). The compilation,
repackaging, dissemination or other use of this Data is expressly
prohibited without the prior written consent of VeriSign. You agree not to
use electronic processes that are automated and high-volume to access or
query the Whois database except as reasonably necessary to register
domain names or modify existing registrations. VeriSign reserves the right
to restrict your access to the Whois database in its sole discretion to ensure
operational stability.  VeriSign may restrict or terminate your access to the
Whois database for failure to abide by these terms of use. VeriSign
reserves the right to modify these terms at any time.

The Registry database contains ONLY .COM, .NET, .EDU domains and
Registrars.
akshat_a18@LAPTOP-R86737RN:~$
```

PuTTY/ Tera Term : It is used for remote access to another host on the same network.

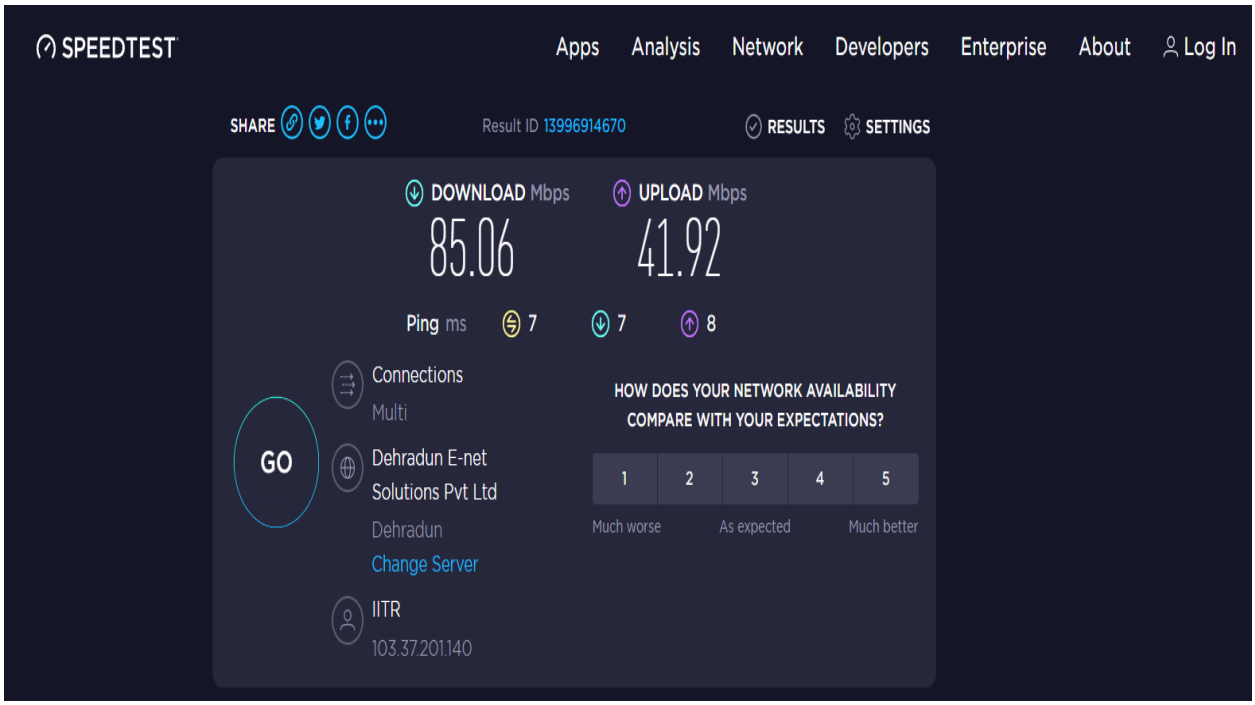




Subnet and IP Calculator : They give us a lot of information about subnet and related information in a jiffy which will take a lot of time for humans to calculate.



Speed test : It helps us to identify how much bandwidth we are having for in (download) and out (upload) on our network.



IP Scanner : There are many devices on a network that don't have a quick interface to tell us what their addresses are such as printers and scanners. An IP Scanner can quickly scan a subnet and display us IP addresses of devices that may otherwise not be visible to us because they do not have an interface.