

ASSIGNMENT-1

COMPUTER NETWORKS (Group 7)

By -

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[Github Repo Link](#)

Part 1: Metrics and Plots (40 pts) From the chosen X.pcap file, extract and generate the following metrics for the data as captured by your program when you perform the pcap replay using tools like tcpreplay:

(NOTE: PCAP file used 7.pcap)

1. Find the total amount of data transferred (in bytes), the total number of packets transferred, and the minimum, maximum, and average packet sizes. Also, show the distribution of packet sizes (e.g., by plotting a histogram of packet sizes).

- Total Packets transferred: **246,519**
- Total Data Transferred: **134,996,148 bytes**
- Minimum Packet Size: **42 bytes**
- Maximum Packet Size: **1514 bytes**
- Average Packet Size: **547 bytes**

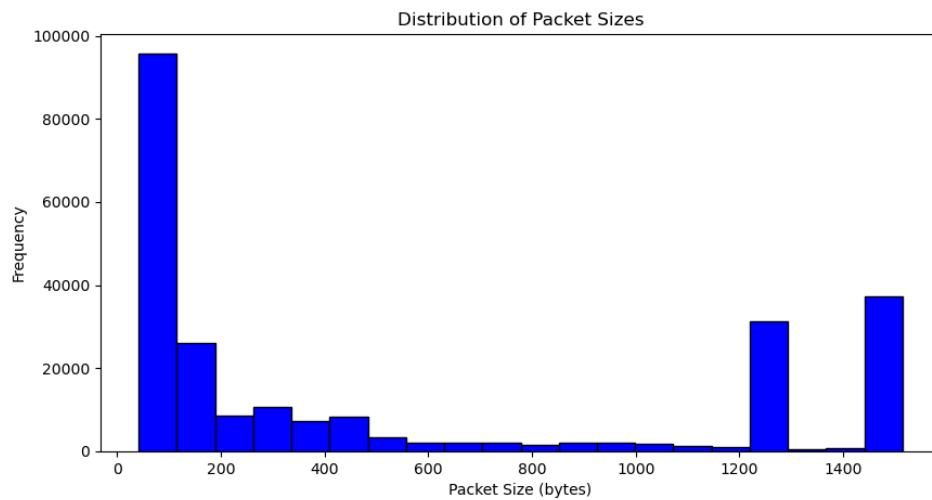


Fig 1. Packet Size Distribution

2. Find unique source-destination pairs (source IP:port and destination IP:port) in the captured data.

===== Unique Source-Destination Pairs =====: 9603

```
[
  [
    "142.250.192.3:443",
    "10.240.0.249:58402"
  ],
  [
    "10.240.10.137:54638",
    "224.0.0.252:5355"
  ],
  [
    "10.0.136.7:53",
    "10.240.0.249:55335"
  ],
  [
    "10.240.7.99:61303",
    "239.255.255.250:1900"
  ],
  [
    "10.240.2.228:47625",
    "239.255.255.250:1900"
  ],
  [
    "185.199.108.153:443",
    "10.240.0.249:58485"
  ],
  [
    "10.240.12.62:33827",
    "239.255.255.250:1900"
  ],
  [
    "52.123.168.132:443",
    "10.240.0.249:59072"
  ],
  [
    "10.240.12.62:34498",
    "239.255.255.250:1900"
  ],
]
```

Fig2. Snapshot of Unique Souce- Destination pair

(Complete JSON file is in the GitHub repo named unique_pairs.json)

3. Display a dictionary where the key is the IP address and the value is the total flows for that IP address as the source. Similarly display a dictionary where the key is the IP address and the value is the total flows for that IP address as the destination. Find out which source-destination (source IP:port and destination IP:port) have transferred the most data

```
CN_Assignment_1 > {} flow_counts_src.json > ...
1 {
2   "249.1.0.0": 2,
3   "147.77.10.7": 2,
4   "10.7.11.235": 2543,
5   "54.236.225.107": 26,
6   "52.1.8.106": 20,
7   "180.149.61.76": 2539,
8   "142.250.192.142": 161,
9   "10.240.8.31": 3149,
10  "142.250.183.78": 49,
11  "142.250.70.100": 3391,
12  "10.0.136.7": 5658,
13  "142.250.194.78": 116,
14  "216.58.200.170": 57,
15  "1.246.10.7": 10,
16  "142.251.42.69": 806,
17  "142.250.192.97": 221,
18  "142.250.70.67": 50,
19  "142.251.12.100": 10,
20  "142.250.194.206": 19,
21  "54.192.142.120": 27,
22  "142.251.175.188": 4
```

Fig 3. Snapshot of Flowcounts for source IP
(Complete JSON file is in GitHub repo named flow_count_scr.json)

```
gnment_1 > {} flow_counts_dest.json > ...
1 {
2   "0.0.192.228": 2,
3   "11.235.112.228": 2,
4   "54.236.225.107": 27,
5   "10.7.11.235": 7897,
6   "52.1.8.106": 16,
7   "180.149.61.76": 393,
8   "142.250.192.142": 143,
9   "10.240.8.31": 2791,
10  "142.250.183.78": 39,
11  "142.250.70.100": 638,
12  "10.0.136.7": 6726,
13  "142.250.194.78": 111,
14  "216.58.200.170": 49,
15  "0.1.255.255": 10,
16  "142.251.42.69": 414,
17  "142.250.192.97": 174,
18  "142.251.12.100": 8,
19  "142.250.70.67": 36,
20  "142.250.194.206": 17,
21  "54.192.142.120": 24,
22  "142.251.175.188": 4,
23  "142.250.192.3": 84
```

Fig 4. Snapshot of Flowcounts for destination IP
(Complete JSON file is in GitHub repo named flow_count_dest.json)

Top Flow: 23.52.40.154:443 -> 10.240.0.249:59231 transferred 19798738 bytes

I) ON SAME Machine

```
devansh@Dewansh:~/CN_Assignment_1$ sudo tcpreplay -i eth0 --pps=10000 7 pcap
Actual: 246519 packets (134996148 bytes) sent in 24.65 seconds
Rated: 5476115.0 bps, 43.80 Mbps, 10000.03 pps
Flows: 9631 flows, 390.68 fps, 208120 unique flow packets, 38397 unique non-f
low packets
Statistics for network device: eth0
    Successful packets:      246519
    Failed packets:         0
    Truncated packets:       0
    Retried packets (ENOBUFS): 0
    Retried packets (EAGAIN): 0

devansh@Dewansh:~/CN_Assignment_1$ 
devansh@Dewansh:~/CN_Assignment_1$ 
devansh@Dewansh:~/CN_Assignment_1$ 
devansh@Dewansh:~/CN_Assignment_1$ 
devansh@Dewansh:~/CN_Assignment_1$ 
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devansh@Dewansh:~/CN_Assignment_1$ 
devansh@Dewansh:~/CN_Assignment_1$ 
devansh@Dewansh:~/CN_Assignment_1$ 

o devansh@Dewansh:~/CN_Assignment_1$ sudo python3 sniffer2.py -i eth0 -o output
.txt
Listening on eth0
Duration of 30 seconds reached. Exiting...

===== Packet Statistics =====
Total Packets: 246519
Total Data Transferred: 134996148 bytes
Min Packet Size: 42 bytes
Max Packet Size: 1514 bytes
Average Packet Size: 547 bytes

===== Unique Source-Destination Pairs =====
9603

===== Flow Counts Per Source IP =====
1226

===== Flow Counts Per Destination IP =====
1294

Top Flow: 23.52.40.154:443 -> 10.240.0.249:59231 transferred 19798738 bytes
```

Using two different machines connected by the RJ45 port using CAT-6 cable, the networks packet transferred were **246519** using **enpl1s0** network interface in one system to **eno1** port of my system at the speed of **5000pps**. The network packet summary is shown below. However, the packets received were larger than the actual packets transferred (one reason can be due to the intercommunication between two systems, which results in transmission of some packets)

```

(.venv) dewansh@dewansh-OMEN-by-HP-Gaming-Laptop-16-wd0xxx:~/Documents/CN_Assignment/Assignment_1$ sudo python3 sniffer2.py -i eno1
Listening on eno1
Duration of 55 seconds reached. Exiting...
Saved statistics to JSON files.

===== Packet Statistics =====
Total Packets: 246576
Total Data Transferred: 135128710 bytes
Min Packet Size: 60 bytes
Max Packet Size: 1514 bytes
Average Packet Size: 548 bytes

===== Unique Source-Destination Pairs =====
9603

===== Flow Counts Per Source IP =====
1226

===== Flow Counts Per Destination IP =====
1296

Top Flow: 23.52.40.154:443 -> 10.240.0.249:59231 transferred 19798738 bytes
(.venv) dewansh@dewansh-OMEN-by-HP-Gaming-Laptop-16-wd0xxx:~/Documents/CN_Assignment/Assignment_1$

```

Snapshot of packets transmitted from one device to another

Network packet statistics were **almost similar** with the previous results achieved on single system transfer (significant change being in **Min packet size shifted from 42 bytes to 60 bytes**)

Our Observations:

We have tried replaying on the network at speeds 7500, 10000, 12500 and 15000 pps but always received packets that were lesser than the packets transmitted.

Also, on replaying the .pcap file on speed 4000, 5000 pps we observed that sometimes the packets received were the same, and sometimes the packets received were greater than the original number of packets.

On replaying the network packets using tcpreplay 10 times with a speed of 5000 pps, we found the exact number of packets that were transmitted by tcpreplay.

Part 2: Catch Me If You Can (40 points)

Q1: TCP Packet with ACK & PSH set, sum of ports = 60303

Count: 0

Q2: SYN Set, Source Port % 11 == 0, Sequence Number > 100000

Count: 223

Source: 10.7.11.235:53669 -> Destination: 10.240.8.31:8009

Source: 10.7.11.235:53669 -> Destination: 10.240.8.31:8009

Source: 10.7.11.235:53669 -> Destination: 10.240.8.31:8009

Source: 10.7.11.235:53669 -> Destination: 10.240.8.31:8009

Source: 10.7.11.235:53680 -> Destination: 3.111.224.186:443

Source: 10.7.11.235:53691 -> Destination: 142.250.199.170:443

Source: 10.240.0.249:55968 -> Destination: 10.0.136.7:53

....

(All source and destination IP address are in the part_2_answers.txt file in the github repo)

Q3: Source IP 18.234.xx.xxx, Prime Src Port, Dest Port % 11 == 0

Count: 11

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Source: 18.234.0.179:443 -> Destination: 10.7.11.235:53251

Q4: Sequence + Ack = 2512800625, Checksum ends in 70

Count: 1

Source: 10.240.8.31:8009 -> Destination: 10.7.11.235:53669

NOTE: These answers are generated by replaying the networks at 10000 pps using TCP replay and running the script part_2.py for duration of 30 seconds

(part_2.py file is provided in the github repository with network interface set as "eth0" provided by WSL)

```
66     ### Important field
67     duration = 30 # Capture packets for 30 seconds
68
```

Fig 7. Snapshot of code from part_2.py showing the line number of duration variable for time adjustments

Part 3: Capture the packets (20 points)

Q1. Run the Wireshark tool and capture the trace of the network packets on your host device. We expect you would be connected to the Internet and perform regular network activities. a. List at-least 5 different application layer protocols that we have not discussed so far in the classroom and describe in 1-2 sentences the operation/usage of protocol and its layer of operation and indicate the associated RFC number if any.

Below are the five application layer protocols :

1. OSCP :

OCSP (Online Certificate Status Protocol)

Layer: Application Layer (Layer 7)

Operation/Usage: OCSP provides real-time verification of digital certificate status (valid, revoked, or unknown) to ensure the validity of SSL/TLS certificates.

RFC: RFC 6960

The image shows a Wireshark packet capture. The packet list on the left shows a sequence of packets, with packet 14220 selected. The packet details pane shows the structure of the OCSP request, including the 'Request' field with a list of certificate serial numbers. The packet bytes pane shows the raw data of the packet.

No.	Time	Source	Destination	Protocol	Length	Info
14204	51.876743	20.247.162.75	10.7.45.49	TCP	1230	443 → 52199 [PSH, ACK] Seq=2921 Ack=294 Win=262144 Len=1176 [TCP PDU reassembled in 14205]
14205	51.876743	20.247.162.75	10.7.45.49	TLSv1.3	1194	Application Data, Application Data
14206	51.877120	10.7.45.49	20.247.162.75	TCP	54	52199 → 443 [ACK] Seq=294 Ack=1461 Win=262144 Len=0
14207	51.877346	10.7.45.49	20.247.162.75	TCP	54	52199 → 443 [ACK] Seq=294 Ack=2921 Win=262144 Len=0
14208	51.877389	10.7.45.49	20.247.162.75	TCP	54	52199 → 443 [ACK] Seq=294 Ack=4897 Win=268064 Len=0
14209	51.877429	10.7.45.49	20.247.162.75	TCP	54	52199 → 443 [ACK] Seq=294 Ack=5237 Win=262144 Len=0
14210	51.883599	10.7.45.49	20.247.162.75	TLSv1.3	134	Change Cipher Spec, Application Data
14211	51.888827	20.247.162.75	10.7.45.49	TCP	60	443 → 52199 [ACK] Seq=5237 Ack=374 Win=262144 Len=0
14212	51.182203	10.7.45.49	10.8.136.7	DNS	81	Standard query 0x9fef A oneosp.microsoft.com CNAME oneosp-microsoft-com.a-0003.a-msedge.net CNAME a-0003.a-msedge.net A 204.79.197.203 NS c.root-servers.net HS a.root-servers.net
14213	51.120444	10.8.136.7	10.7.45.49	DNS	550	Standard query response 0x9fef A oneosp.microsoft.com CNAME oneosp-microsoft-com.a-0003.a-msedge.net CNAME a-0003.a-msedge.net A 204.79.197.203 NS c.root-servers.net HS a.root-servers.net
14214	51.121575	10.7.45.49	204.79.197.203	TCP	66	52200 → 80 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM
14215	51.135971	204.79.197.203	10.7.45.49	TCP	66	80 → 52200 [SYN, ACK] Seq=0 Ack=1 Win=65535 Len=0 MSS=1460 WS=256 SACK_PERM
14216	51.136119	10.7.45.49	204.79.197.203	TCP	54	52200 → 80 [ACK] Seq=0 Ack=1 Win=132352 Len=0
14217	51.136406	10.7.45.49	204.79.197.203	HTTP	303	GET /ocsp/0x9fef0e4u0d38gldgKcGdUAB85c782fzqncqhvH914c4sCp213brnQUR2f61xQUFEETyp1f1u34eUo6lqgCfzBancJVQqadAdJdYAAAFqclK30 HTTP/1.1
14218	51.150827	204.79.197.203	10.7.45.49	TCP	60	80 → 52200 [ACK] Seq=1 Ack=250 Win=434304 Len=0
14219	51.152767	204.79.197.203	10.7.45.49	TCP	1514	80 → 52200 [ACK] Seq=1 Ack=250 Win=434304 Len=1460 [TCP PDU reassembled in 14220]
14220	51.152767	204.79.197.203	10.7.45.49	OCSP	1055	Response
14221	51.152664	10.7.45.49	204.79.197.203	TCP	54	52200 → 80 [ACK] Seq=250 Ack=2462 Win=132352 Len=0
14222	51.153950	20.247.162.75	10.7.45.49	TLSv1.3	357	Application Data
14223	51.153950	20.247.162.75	10.7.45.49	TLSv1.3	357	Application Data
14224	51.154099	10.7.45.49	20.247.162.75	TCP	54	52199 → 443 [ACK] Seq=374 Ack=5540 Win=261632 Len=0
14225	51.154163	10.7.45.49	20.247.162.75	TCP	54	52199 → 443 [ACK] Seq=374 Ack=5843 Win=261376 Len=0
14226	51.140930	10.7.45.49	20.247.162.75	TLSv1.3	1113	Application Data
14227	51.160593	10.7.45.49	20.247.162.75	TLSv1.3	1359	Application Data
14228	51.162879	20.247.162.75	10.7.45.49	TCP	60	443 → 52199 [ACK] Seq=5843 Ack=3130 Win=262144 Len=0
14229	51.160877	20.247.162.75	10.7.45.49	TLSv1.3	1138	Application Data
14230	51.160967	10.7.45.49	20.247.162.75	TCP	54	52199 → 443 [ACK] Seq=3138 Ack=7125 Win=262144 Len=0

Frame 14220: 1055 bytes on wire (8440 bits), 1055 bytes captured (8440 bits) on interface vDevice\NPF_{20A3832E-4503-4C0B-8326-ED1CFB...} (eth0) on interface vDevice\NPF_{20A3832E-4503-4C0B-8326-ED1CFB...} (eth0)

Ethernet II, Src: Cisco-Ethernet (08:00:0c:2c:36:f7), Dst: Intel 02:14:00:00:53:54:00

Internet Protocol Version 4, Src: 204.79.197.203, Dst: 10.7.45.49

Transmission Control Protocol, Src Port: 80, Dst Port: 52200, Seq: 1461, Ack: 250, Len: 1001

[2] Reassembled TCP Segments (2461 bytes): #14219(1408), #14220(1001)

Hypertext Transfer Protocol

Online Certificate Status Protocol

2. BROWSER

BROWSER (Windows Browser Protocol)

Layer: Application Layer (Layer 7)

Operation/Usage: The Windows Browser Protocol allows devices in a local network to discover shared resources like files and printers, particularly in older Windows environments.

RFC: RFC 1001 and RFC 1002

3. AJP13 (Apache JServ Protocol version 1.3)

RFC: RFC 213

Time	Source	Destination	Protocol	Length	Info
1 0.00000	Cisco-ccr19:01	Intel-67154:00	ARP	60	who has 10.7.45.49? Tell 0.0.0.0
2 0.00003	Intel-67154:00	Cisco-ccr19:01	ARP	42	10.7.45.49 is at 00:50:10:01:00:02
3 1.4779705	104.215.40.100	104.215.40.100	TLSv1.2	183	Application Data
4 3.49949	104.215.40.100	107.45.49	TCP	60	443 → [ESTAB] [ACK] Seq=14650 Win=4096 Len=0
5 3.610105	104.215.40.100	107.45.49	TLSv1.1	92	Application Data
6 3.610104	107.45.49	104.215.40.100	TCP	54	64343 → 443 [ACK] Seq=508 Acks=39 Win=580 Len=0
7 3.6129734	Intel-67154:00	Intel-67154:00	CHNMG	17	CHNMG: I have 10.7.45.49
8 3.6129734	107.45.49	104.215.40.100	DNS	87	Standard query 0x2048 0 assets.activity.windows.com
9 4.786273	104.215.40.100	107.45.49	DNS	545	Standard query response 0x2048 0 assets.activity.windows.com CHNMG asset.gtrafficmanager.net A 20.44.229.37 NS a.root-servers.net NS b.root-servers.net NS c.root-servers.net NS d.root-servers.net NS e.root-servers.net NS f.root-servers.net NS g.root-servers.net NS h.root-servers.net NS i.root-servers.net NS j.root-servers.net NS k.root-servers.net NS l.root-servers.net NS m.root-servers.net NS n.root-servers.net NS o.root-servers.net NS p.root-servers.net NS q.root-servers.net NS r.root-servers.net NS s.root-servers.net NS t.root-servers.net NS u.root-servers.net NS v.root-servers.net NS w.root-servers.net NS x.root-servers.net NS y.root-servers.net NS z.root-servers.net NS .root-servers.net
10 4.786272	107.45.49	20.44.229.37	TCP	66	20487 → 443 [SWN] Seq=14650400 Len=0 MSS=1460 SACK_PERM=1
11 4.792677	104.224.229.37	107.45.49	TCP	66	443 → 52437 [SWN, ACK] Seq=0 Acks=115553 Len=0 MSS=1460 SACK_PERM=1
12 4.792769	107.45.49	20.44.229.37	TCP	54	52437 → 443 [ACK] Seq=1461 Win=11328 Len=0
13 4.792610	107.45.49	20.44.229.37	TLSv1.3	343	Client Hello [0x1assets.activity.windows.com]
14 4.796115	20.44.229.37	107.45.49	TCP	60	[TCP Window update] 443 → 52437 [ACK] Seq=1 Acks=1 Win=262144 Len=0
15 4.805734	20.44.229.37	107.45.49	TCP	443 → 52437 [ACK] Seq=1 Acks=290 Win=261120 Len=0	
16 5.009639	107.45.49	10.18.15.67	DNS	78	Standard query 0x5020 0 edge.microsoft.com
17 5.009639	107.45.49	10.18.15.67	DNS	78	Standard query 0x1414 HTTPS edge.microsoft.com
18 5.009639	107.45.49	10.18.15.67	DNS	537	Standard query response 0x5020 0 edge.microsoft.com CHNMG edge-microsoft-com.dual-a-0036-a-sedge.net CHNMG dual-a-0036-a-sedge.net A 13.107.21.239 A 204.79.197.259 NS b.root-servers.net
19 5.012106	107.45.49	107.45.49	DNS	66	Standard query response 0x1414 HTTPS edge.microsoft.com CHNMG edge-microsoft-com.dual-a-0036-a-sedge.net CHNMG dual-a-0036-a-sedge.net SOA ns1.a-sedge.net
20 5.012106	107.45.49	107.45.49	TCP	66	52438 → 443 [SWN] Seq=1461 Acks=115553 Len=0 MSS=1460 SACK_PERM=1
21 5.015511	13.107.21.239	107.45.49	TCP	66	443 → 52438 [SWN, ACK] Seq=1 Acks=115553 Len=0 MSS=1460 SACK_PERM=1
22 5.015507	107.45.49	13.107.21.239	TCP	54	52438 → 443 [ACK] Seq=1 Acks=1 Win=11328 Len=0
23 5.015508	107.45.49	13.107.21.239	TLSv1.2	1814	Client Hello [0x1edge.microsoft.com]
24 5.018811	13.107.21.239	107.45.49	TCP	60	[TCP Window update] 443 → 52438 [ACK] Seq=1 Acks=1 Win=262144 Len=0
25 5.018811	13.107.21.239	107.45.49	TCP	643 → 52438 [ACK] Seq=1 Acks=1761 Win=208352 Len=0	
26 5.041570	13.107.21.239	107.45.49	TCP	1514	443 → 52438 [PSH, ACK] Seq=1 Acks=1761 Win=262144 Len=1460 [TCP PSH ressembled in 30]
27 5.042977	13.107.21.239	107.45.49	TCP	1514	443 → 52438 [PSH, ACK] Seq=1 Acks=1761 Win=262144 Len=1460 [TCP PSH ressembled in 30]
28 5.042977	107.45.49	13.107.21.239	TCP	1514	443 → 52438 [PSH, ACK] Seq=1 Acks=1761 Win=262144 Len=1460 [TCP PSH ressembled in 30]

```

# Frame 7: 147 bytes on wire (1176 bits), 147 bytes captured (1176 bits) on interface Vmnic000 [eth0/33:03:00:00:00:00]
# Ethernet II, Src: Intel-67154:00, Dst: IntelMac 01:00:02: (33:33:00:01:00:02)
# Internet Protocol Version 6, Src: Fe80::e884:af44:3083, Dst: Ffd0::1:1:2
# User Datagram Protocol, Src Port: 543, Dst Port: 543

```

```

# Message Type: Solicit (1)
# Transaction ID: 0x0400d7
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1

5. SSDP (Simple Service Discovery Protocol)

Layer: Application Layer (Layer 7)

Operation/Usage: SSDP is used for the discovery of network devices and services, such as printers or smart TVs, in a local network using multicast.

RFC: RFC 6776

No.	Time	Source	Destination	Protocol	Length	Info
65	5.225534	10.7.45.49	20.44.229.37	TCP	54	52437 → 443 [ACK] Seq=500 Ack=5940 Win=131328 Len=0
66	5.236669	10.7.45.49	20.44.229.37	TLSv1.3	128	Application Data
67	5.241902	10.7.45.49	20.44.229.37	TLSv1.3	1784	Application Data
68	5.241934	10.7.45.49	20.44.229.37	TLSv1.3	818	Application Data
69	5.242436	10.7.45.49	20.44.229.37	TCP	60	443 → 52437 [ACK] Seq=6182 Ack=2184 Win=262144 Len=0
70	5.244316	10.7.45.49	20.44.229.37	TCP	60	443 → 52437 [ACK] Seq=6182 Ack=5180 Win=262144 Len=0
71	5.389231	20.44.229.37	10.7.45.49	TLSv1.3	157	Application Data
72	5.123035	10.7.45.49	20.44.229.37	TLSv1.3	145	Application Data
73	5.132796	10.7.45.49	20.44.229.37	TCP	54	52437 → 443 [ACK] Seq=3188 Ack=6376 Win=130816 Len=0
74	5.134385	10.7.45.49	20.44.229.37	TLSv1.3	168	Application Data
75	5.330234	20.44.229.37	10.7.45.49	TCP	60	443 → 52437 [ACK] Seq=6376 Ack=3382 Win=262144 Len=0
76	5.384438	20.44.229.37	10.7.45.49	TLSv1.3	157	Application Data
77	5.428891	10.7.45.49	20.44.229.37	TCP	54	52437 → 443 [ACK] Seq=3382 Ack=6479 Win=130816 Len=0
78	5.431073	fe80::e884::adff::16	fe80::116	ICMPv6	90	Multicast Listener Report Message v2
79	5.432401	10.7.45.49	224.0.0.2	IGMPv3	54	Membership Report / Join group 239.255.255.250 for any sources
80	5.437475	10.7.45.49	239.255.255.250	SSDP	179	M-SEARCH * HTTP/1.1
81	5.447577	10.7.45.49	239.255.255.250	SSDP	179	M-SEARCH * HTTP/1.1
82	5.666176	10.7.45.49	239.255.255.250	SSDP	179	M-SEARCH * HTTP/1.1
83	5.838087	10.7.45.49	224.0.0.22	IGMPv3	54	Membership Report / Join group 239.255.255.250 for any sources
84	5.838283	fe80::e884::adff::16	fe80::116	ICMPv6	90	Multicast Listener Report Message v2
85	6.555532	10.7.45.49	10.136.7.6	DNS	96	Standard query 0xb92d A function.events.data.microsoft.com
86	6.555881	10.7.45.49	10.136.7.6	DNS	96	Standard query 0xb998 HTTPS function.events.data.microsoft.com
87	6.618935	10.136.7.6	10.7.45.49	TCP	268	Standard query response 0xb92d HTTPS function.events.data.microsoft.com CWAVE global.asimov.events.data.trafficmanager.net CWAVE onedocsprodus1.eastus.cloudapp.azure.com S0A 311-201-az
88	6.618936	10.136.7.6	10.7.45.49	TCP	135	Standard query response 0xb998 A function.events.data.microsoft.com CWAVE global.asimov.events.data.trafficmanager.net CWAVE onedocsprodus1.eastus.cloudapp.azure.com A 20.42.73.30 MS
89	6.621672	10.7.45.49	20.42.73.30	TCP	66	52441 → 443 [SYN] Seq=6000420 Len=0 Win=16368 RS=256 SCV=PMH
90	6.660286	20.42.73.30	10.7.45.49	TCP	60	443 → 52441 [ACK] Seq=61400 Len=0 Win=5535 Len=0 Seq=61400 SCV=PMH
91	6.624441	10.7.45.49	20.42.73.30	TCP	60	52441 → 443 [ACK] Seq=61400 Len=0 Win=131328 Len=0
92	6.660308	10.7.45.49	20.42.73.30	TCP	135	Standard query response 0xb92d A function.events.data.microsoft.com
<pre> # Frame 80: 179 bytes on wire (1432 bits), 179 bytes captured (1432 bits) on interface Device\WFP_{D8A3832E-450B-430B-8326-EDCF8EE2A0F0} # Ethernet II, Src: Intel_07:54:00 (08:00:27:54:00:08), Dst: IntelMulticast_Tp7:fffa (01:00:5e:7f:ff:fa) # Internet Protocol Version 4, Src: 10.7.45.49, Dst: 239.255.255.250 # User Datagram Protocol, Src Port: 64458, Dst Port: 1900 # Simple Service Discovery Protocol </pre>						
0000	00	00	5e 7f ff fa	60	50	67 54 80 08 00 05 00
0010	00	05	09 08 00 06 00 11	00	00	0a 07 20 31 01 07
0020	ff fa	20 31 01 07	00 00 00 01	c2	44	46 2d 53 61 15 15
0030	43 48	20 3a 20 48 54 5a	50	2f	31	2e 31 0d 0a 08
0040	67	54 80 3a 20 39 30	20	32	35	3c 20 2e 35 05
0050	20	32 35 3c 20 3a 39 30	30	00	0a	00 53 54 20 3a 20 75
0060	72	6e 3a 73 63 68 65 6d	61	73	2d	75 76 70 7d 20
0070	67	54 80 3a 20 39 30 69	63	65	3a	49 6e 63 65 69 63
0080	6e 65 74 47 61 74 65 77	61	79	44	65	65 76 69 63 65
0090	31	0d 0a 08 6d 61 6e 3a	20	72	73	73 64 70 3a 64
0100	69 73 63 47 69 70 72	0d	0a	4d	58	3a 20 31 0d
0110	0a	0d	0a			

Q2:

Analyze the following details by visiting the following websites in your favorite browser.

i) canarabank.in

ii) github.com

iii) netflix.com

a. Identify 'the request line' with the version of the application layer protocol and the IP address. Also, identify whether the connection(s) is/are persistent or not.

b. For any one of the websites, list any three header field names and corresponding values in the request and response message. Any three HTTP error codes obtained while loading one of the pages with a brief description.

c. Capture the Performance metrics that your browser records when a page is loaded and also report the list the cookies used and the associated flags in the request and response headers. Please report the browser name and screenshot of the performance metrics reported for any one of the page loads

Ans a :

i) canara bank

```
(pranjal@Lappy)~$ curl -v canarabank.in
* Could not resolve host: canarabank.in
* Closing connection
curl: (6) Could not resolve host: canarabank.in

(pranjal@Lappy)~$ curl -v canarabank.com
* Host canarabank.com:80 was resolved.
* IPv6: 2401:8800:a50:4::3
* IPv4: 107.162.160.8
* Trying 107.162.160.8:80...
* Connected to canarabank.com (107.162.160.8) port 80
> GET / HTTP/1.1
> Host: canarabank.com
> User-Agent: curl/8.8.0
> Accept: */*
>
* Request completely sent off
* HTTP 1.0, assume close after body
< HTTP/1.0 302 Moved Temporarily
< Location: https://canarabank.com/
< Via: HTTP/1.1 bit29005.sin1.defense.net
< Connection: close
< Content-Length: 0
<
* Closing connection
```

Request Line : GET / HTTP/1.1
IP Address : 107.162.160.8
Persistent : No

ii) github.com

```
(pranjal@Lappy)~$ curl -v github.com
* Host github.com:80 was resolved.
* IPv6: (none)
* IPv4: 20.207.73.82
* Trying 20.207.73.82:80...
* Connected to github.com (20.207.73.82) port 80
> GET / HTTP/1.1
> Host: github.com
> User-Agent: curl/8.8.0
> Accept: */*
>
* Request completely sent off
< HTTP/1.1 301 Moved Permanently
< Content-Length: 0
< Location: https://github.com/
<
* Connection #0 to host github.com left intact
```

Request Line: GET / HTTP/1.1
IP Address : 20.207.73.82
Persistent : Yes

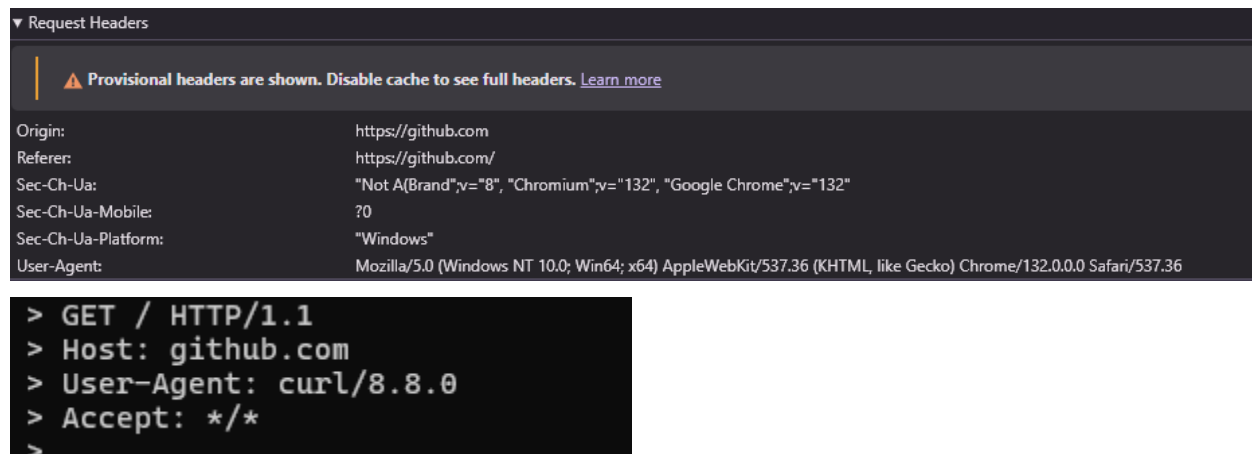
iii) netflix.com

```
(pranjal@Lappy)~$ curl -v netflix.com
* Host netflix.com:80 was resolved.
* IPv6: 2a05:d018:76c:b683:a2cd:4240:8669:6d4, 2a05:d018:76c:b685:e8ab:afd3:af51:3aed, 2a05:d018:76c:b684:8ab7:ac92:667b:e863
* IPv4: 54.73.148.110, 54.155.246.232, 18.200.8.190
* Trying 54.73.148.110:80...
* Connected to netflix.com (54.73.148.110) port 80
> GET / HTTP/1.1
> Host: netflix.com
> User-Agent: curl/8.8.0
> Accept: */*
>
* Request completely sent off
< HTTP/1.1 301 Moved Permanently
< Location: https://netflix.com/
< Content-Length: 0
< Via: 1.1 i-0678bdb62578ac77d (eu-west-1)
< X-Xss-Protection: 1; mode=block; report=https://www.netflix.com/ichnaea/log/freeform/xssreport
< X-Content-Type-Options: nosniff
< Strict-Transport-Security: max-age=31536000; includeSubDomains
< X-Originating-URL: http://netflix.com/
< Set-Cookie: nfvdid=BQFmAAEBEDCuHj6Vgx4DeFIkHdEvBZAoo4rwpPIp63gz96X-bjji_QpkQnvaIQ3iowHnFS4TTrOb8chu_2N655ALVn0-SaPUCnT8aJ8ojNsB7rCUGZefA%3D%3D; Domain=.netflix.com; Path=/; Max-Age=31536000
< X-Netflix-nfstatus: 1 21
< X-Netflix-proxy.execution-time: 2
<
* Connection #0 to host netflix.com left intact
```

Request Line : GET / HTTP/1.1
IP Address : 54.73.148.110, 54.155.246.232, 18.200.8.190
Persistent: Yes

Ans b)

Request header :



The image shows a browser's developer tools interface. The top section, titled 'Request Headers', displays a list of headers for a request to github.com. Below this, a terminal window shows the output of a curl command.

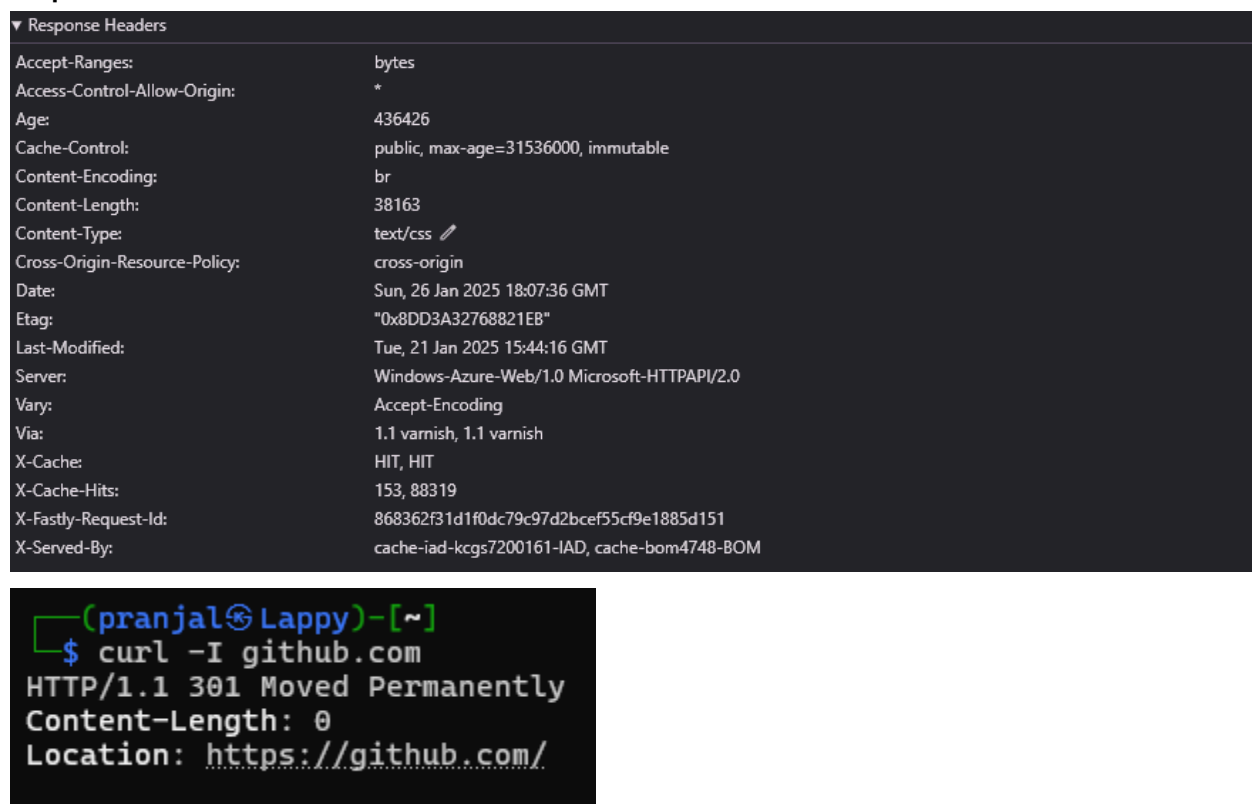
Request Headers:

Header	Value
Origin	https://github.com
Referer	https://github.com/
Sec-Ch-Ua	"Not A(Brand";v="8", "Chromium";v="132", "Google Chrome";v="132"
Sec-Ch-Ua-Mobile	?0
Sec-Ch-Ua-Platform	"Windows"
User-Agent	Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/132.0.0.0 Safari/537.36

Terminal Output:

```
> GET / HTTP/1.1
> Host: github.com
> User-Agent: curl/8.8.0
> Accept: */*
>
```

Response Header :



The image shows a browser's developer tools interface. The top section, titled 'Response Headers', displays a list of headers for a response from github.com. Below this, a terminal window shows the output of a curl command.

Response Headers:

Header	Value
Accept-Ranges	bytes
Access-Control-Allow-Origin	*
Age	436426
Cache-Control	public, max-age=31536000, immutable
Content-Encoding	br
Content-Length	38163
Content-Type	text/css
Cross-Origin-Resource-Policy	cross-origin
Date	Sun, 26 Jan 2025 18:07:36 GMT
Etag	"0x8DD3A32768821EB"
Last-Modified	Tue, 21 Jan 2025 15:44:16 GMT
Server	Windows-Azure-Web/1.0 Microsoft-HTTPAPI/2.0
Vary	Accept-Encoding
Via	1.1 varnish, 1.1 varnish
X-Cache	HIT, HIT
X-Cache-Hits	153, 88319
X-Fastly-Request-Id	868362f31d1f0dc79c97d2bcef55cf9e1885d151
X-Served-By	cache-iad-kcgs7200161-IAD, cache-bom4748-BOM

Terminal Output:

```
(pranjal@Lappy)~$ curl -I github.com
HTTP/1.1 301 Moved Permanently
Content-Length: 0
Location: https://github.com/
```

HTTP Error Codes

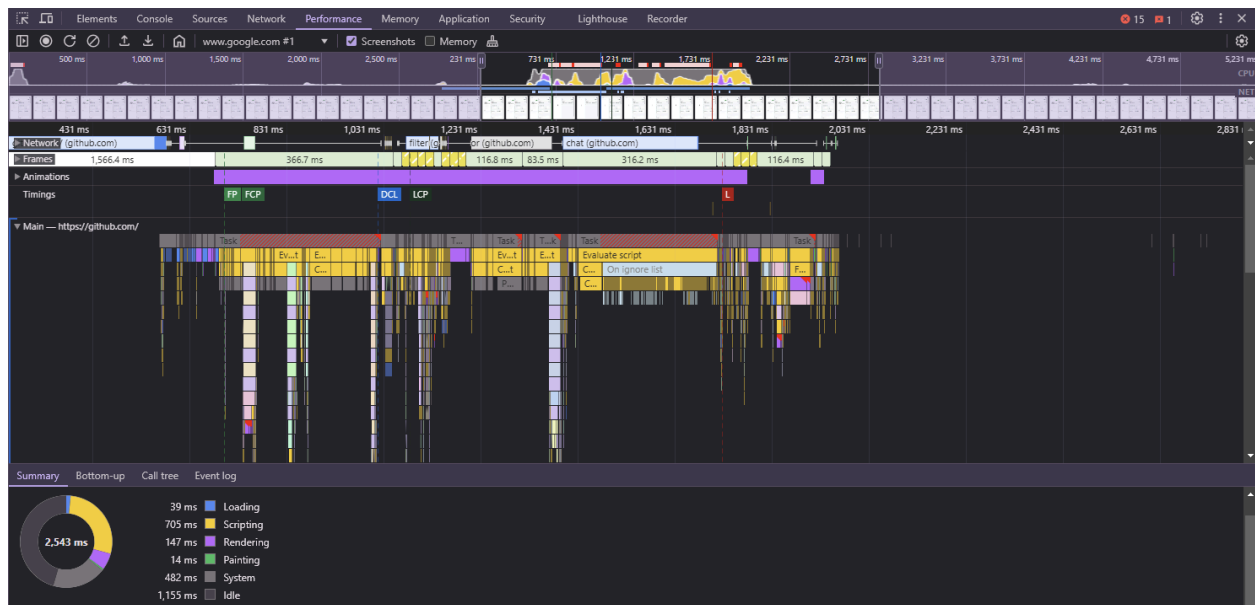
- **404 Not Found:** This error occurs when the requested resource is not found on the server.
- **500 Internal Server Error:** A general server-side error indicating that something went wrong on the server while processing the request.
- **403 Forbidden:** The server understands the request but refuses to authorize it. This usu-

ally happens due to permission issues.

Ans c)

For github.com :

Performance Metric :



List of Cookies :

Name	Value	Domain	Path	Expires / ...	Size	HttpOnly	Secure	SameSite	Partition ...	Cross Site	Priority
_Host-user_session_same_site	gkT4Cy28swno5mzl-NcT4l1J8nOCwsfgpJ9_VIOr-QS09F6Y	github.co...	/	2025-02-...	77	✓	✓	Strict			Medium
_device_id	4606a093f8e97635719003ca39efa867	github.co...	/	2026-02-...	42	✓	✓	Lax			Medium
_gh_sess	i92U8ueN8bxLw4pbUwR%2Bf6%2Btho2ULk8BACxqA5phP...	github.co...	/	Session	462	✓	✓	Lax			Medium
_octo	GH11.1429392755.1729663225	github.co...	/	2025-10-...	38	✓	✓	Lax			Medium
color_mode	%7B%22color_mode%22%3A%22auto%22%2C%22light_the...	github.co...	/	Session	216		✓	Lax			Medium
cpu_bucket	xlg	github.co...	/	Session	13		✓	Lax			Medium
dotcom_user	pranjal1519sgaur	github.co...	/	2026-01-...	27	✓	✓	Lax			Medium
logged_in	yes	github.co...	/	2026-01-...	12	✓	✓	Lax			Medium
preferred_color_mode	dark	github.co...	/	Session	24		✓	Lax			Medium
saved_user_sessions	136556627K3AgkT4Cy28swno5mzl-NcT4l1J8nOCwsfgpJ9_V...	github.co...	/	2025-04-...	79	✓	✓	Lax			Medium
tz	Asia%2FCalcutta	github.co...	/	Session	17		✓	Lax			Medium
user_session	gkT4Cy28swno5mzl-NcT4l1J8nOCwsfgpJ9_VIOr-QS09F6Y	github.co...	/	2025-02-...	60	✓	✓	Lax			Medium