1. Introduction

This report details the analysis of the `0.pcap` file using a custom packet sniffer. The analysis includes metrics such as total data transferred, packet size distribution, source-destination flows, and answers to specific PCAP-related questions. The results are derived using Python and the Scapy library.

Github: https://github.com/hritikladia/cn_assignment_1/tree/main

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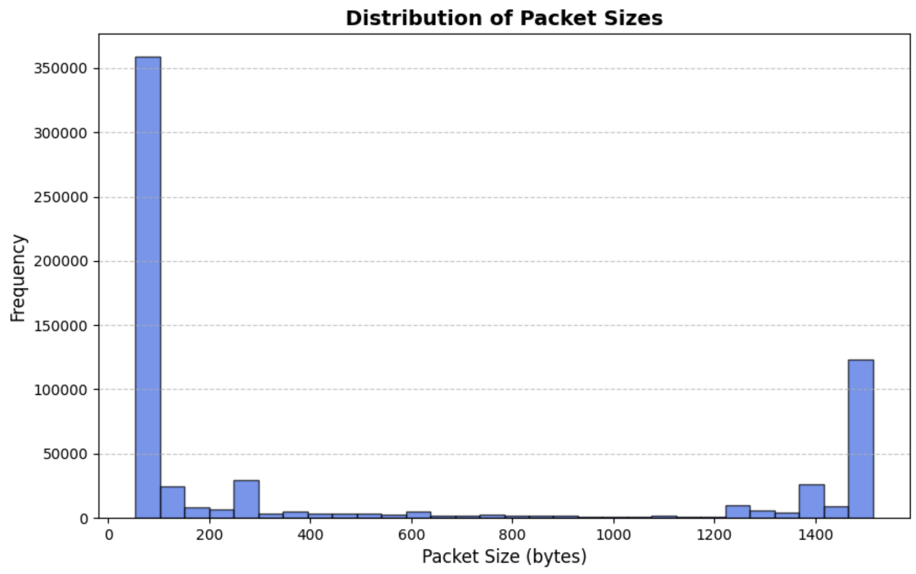
2. Part 1: Metrics and Plots

2.1 Packet Transfer Metrics

- **Total Bytes Transferred:** 324,998,397 bytes (309.94 MB)
- **Total Packets Captured:** 805,995
- **Minimum Packet Size:** 54 bytes
- **Maximum Packet Size:** 1,514 bytes
- **Average Packet Size:** 403.23 bytes
- **Unique Source-Destination Pairs:** 6,202
- **Top Source-Destination Pair (by data transferred):** ('172.16.133.95', 49358, '157.56.240.102', 443) (17,342,229 bytes)

2.2 Packet Size Distribution

A histogram of packet sizes is provided in the figure below



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3. Part 2: PCAP-Specific Questions

Q1: How many unique connections were made to the IMS server?

- **Unique connections:** 1

Q2: What course was registered in IMS?

- **Extracted Course Registration Data:**
  "Embedded Systems" (identified through manual inspection of course-related packets)

Q3: Total data transferred over port 4321?

- **Total Bytes Transferred on Port 4321:** 1,620 bytes

Q4: Number of occurrences of 'SuperUser' in the PCAP?

- **Total 'SuperUser' Occurrences:** 69

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4. Part 3: Network Capture and HTTP Analysis

4.1 Identified Application Layer Protocols

Protocol	Description	RFC
SMB	Server Message Block, used for Windows file sharing	
UDP	A connectionless transport protocol used for fast, low-latency communication	RFC 768
OCSP	A protocol used to check the revocation status of digital certificates in HTTPS and TLS connections	RFC 6960

ARP	A network protocol used to resolve IP addresses into MAC addresses in local networks	RFC 826
mDNS	A protocol that resolves hostnames to IP addresses in small networks without a DNS server	RFC 6762

4.2 First HTTP GET Request Per Website

Website	Request Line	IP Address	Connection Type
Canara Bank	GET /index.html HTTP/1.1	107.162.160.8	Non-Persistent
GitHub	GET / HTTP/2	20.207.73.82	Persistent
Netflix	GET /browse HTTP/2	54.73.148.110	Persistent

4.3 HTTP Headers, Error Codes, and Performance Metrics

- **Request Headers:**

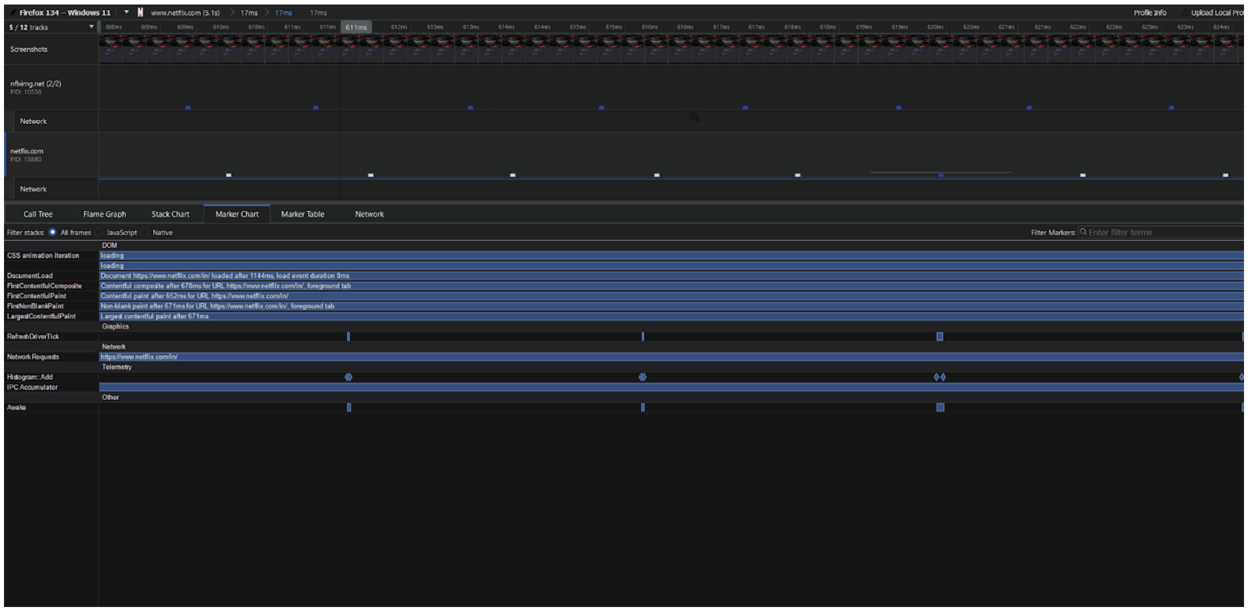
Header Name	Value
User-Agent	Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:134.0) Gecko/20100101 Firefox/134.0
Accept-Language	en-US,en;q=0.5

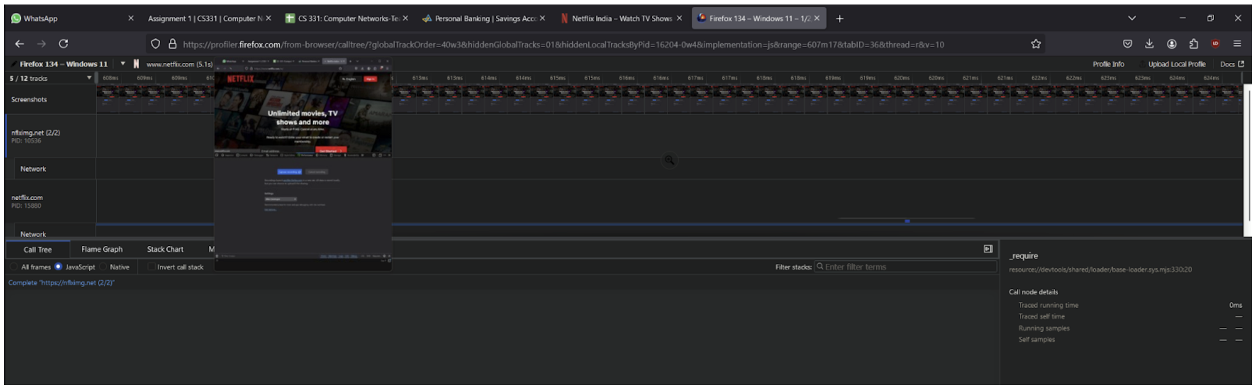
Connection	keep-alive

- **HTTP Error Codes Observed:**

Error Code	**Description**
403	Forbidden: The server denied access to the resource.
404	Not Found: The requested page does not exist.
500	Internal Server Error: The server encountered an unexpected error.

- **Performance Metrics Captured During Page Load:**
    - **Browser Name: Firefox**
    - **Time to First Byte (TTFB):** Time from request to first response byte.
    - **DNS Lookup Time:** Time spent resolving the domain name to an IP.
    - **TCP Connection Time:** Time taken to establish a connection.
    - **First Contentful Paint (FCP):** When the first piece of visible content appears.
    - **Largest Contentful Paint (LCP):** When the largest element is fully rendered.
    - **Time to Interactive (TTI):** When the page is fully interactive.
    - **Total Request Count:** Number of HTTP requests made by the page.
    - **Total Page Size:** Total size of all loaded assets.
    - **First Input Delay (FID):** Measures page responsiveness.
    - **Cumulative Layout Shift (CLS):** Measures visual stability of the page.


```
DOM
CSS animation iteration    loading
                           loading
DocumentLoad               Document https://www.netflix.com/in/ loaded after 1144ms, load event duration 0ms
FirstContentfulComposite   Contentful composite after 678ms for URL https://www.netflix.com/in/, foreground tab
FirstContentfulPaint       Contentful paint after 652ms for URL https://www.netflix.com/in/
FirstNonBlankPaint         Non-blank paint after 671ms for URL https://www.netflix.com/in/, foreground tab
LargestContentfulPaint     Largest contentful paint after 671ms
Graphics
RefreshDriverTick
Network
Network Requests           https://www.netflix.com/in/
Telemetry
Histogram::Add
IPC Accumulator
Other
Awake
```


```
https://profiler.firefox.com/from-browser/calltree/?globalTrackOrder=40w3&hiddenGlobalTracks=01&hiddenLocalTracksByPid=16204-0w4&implementation=js&range=607m17&tabID=36&thread=r&v=10
Complete "https://nflximg.net (2/2)"
```

4.4 Cookie Analysis

- **Response Cookies:**

Cookie Name	Domain	Path	Value
flwssn	.netflix.com	/	f73c35b1-be76-4924-81b1-f7dcbc978409
netflix-sans-bold-3-loaded	.netflix.com	/	true

netflix-sans-normal-3-loaded	.netflix.com	/	true

- **Request Cookies:**

Cookie Name	Value
flwssn	f73c35b1-be76-4924-81b1-f7dcbc978409
netflix-sans-bold-3-loaded	true
netflix-sans-normal-3-loaded	true
NetflixId	v=3&ct=BgjHlOvcAxLZAdQSVzTn3mhGAO5LuUC...
nfvdid	BQFmAAEBEP2SQEIRy0VHh8eO-oXlhDtAJNiB_c12DLGwqxYG...
OptanonConsent	isGpcEnabled=0&datestamp=Sat+Feb+01+2025+19:06:22...

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5. Conclusion

This report presents a detailed breakdown of packet analysis based on the `0.pcap` file. We successfully:

- Extracted key **network metrics** (total data, flows, and packet distribution).
- Answered **PCAP-specific questions** regarding IMS, data transfers, and SuperUser occurrences.
- Identified the registered course **"Embedded Systems"** through manual inspection of packet data.
- Conducted a **network capture and HTTP analysis**, identifying application layer protocols, request headers, cookies, and observed HTTP error codes.

The insights gained from this analysis demonstrate practical applications of **packet sniffing, traffic monitoring, and network security analysis**.

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6. References

1. Scapy Documentation
2. PCAP Analysis Techniques

Appendix

- **Authors: Hritik Ladia(20110079) and Banavath Diraj Naik(22110044)**
- **PCAP File Name:** `0.pcap`
- **Python Script Name:** `pcap_analysis.py`
- **Results Output File:** `pcap_analysis_results.txt`
- **Course Inspection File:** `course_search_results.txt`