PCAP Traffic Analysis Report Using PyShark

1. Introduction

This report documents the analysis of network traffic captured using **Wireshark** and saved as a **PCAP file**, which was later examined using a custom Python script built with the **PyShark** library. The goal of this analysis is to extract and review **DNS queries**, **HTTP requests**, and **TCP sessions** in order to identify potentially **suspicious or noteworthy network activity**.

The analyzed traffic was captured from a live network interface and exported from Wireshark into a .pcap file for offline inspection.

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2. Objective

The main objectives of this analysis are:

- To parse DNS traffic and identify queried domain names.
- To inspect HTTP requests for visible methods, hosts, and requested resources.
- To enumerate TCP sessions to understand communication flows between hosts.
- To demonstrate how PyShark can be used for basic network forensics and traffic inspection.

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3. Tools & Technologies Used

- **Wireshark** – Used to capture live network traffic and export it as a PCAP file.
- **Python 3**
- **PyShark** – A Python wrapper for TShark (Wireshark CLI).
- **TShark** – Backend packet analysis engine used by PyShark.

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4. Methodology

The analysis process follows these steps:

1. Capture network traffic using Wireshark.
2. Save the capture as a .pcap file.

3. Load the PCAP file into Python using PyShark.
4. Apply protocol-based display filters (DNS, HTTP, TCP).
5. Extract relevant fields from each protocol.
6. Print findings to the console for review.

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5. Script Overview

The script consists of four main functions:

5.1 DNS Traffic Analysis (parse_dns)

- Applies the dns display filter.
- Extracts queried domain names (qry_name).
- Stores all DNS queries found in the capture.

Purpose:
Identify domain lookups which may indicate:

- Command-and-control communication
- Suspicious or unknown domains
- DNS tunneling behavior (in advanced cases)

5.2 HTTP Traffic Analysis (parse_http)

- Applies the http display filter.
- Extracts:
    - HTTP request method
    - Host header
    - Requested URI

Purpose:
Detect:

- Cleartext HTTP communication
- Suspicious endpoints

- Unusual request paths or hosts
- Possible data exfiltration over HTTP

5.3 TCP Session Enumeration (parse_tcp_sessions)

- Applies the tcp display filter.
- Extracts:
  - Source IP and port
  - Destination IP and port
- Builds a readable session format.

Purpose:
Understand:

- Communication relationships between hosts
- Potential unauthorized connections
- Lateral movement patterns

5.4 Main Analysis Function (analyze_pcap)

- Coordinates all parsing functions.
- Prints categorized results:
  - DNS queries
  - HTTP requests
  - TCP sessions
- Gracefully handles missing protocol fields.

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6. Input Data

- **PCAP File:** sample_traffic.pcap
- **Source:** Captured directly from Wireshark

- **Traffic Type:** Real network traffic (not simulated)

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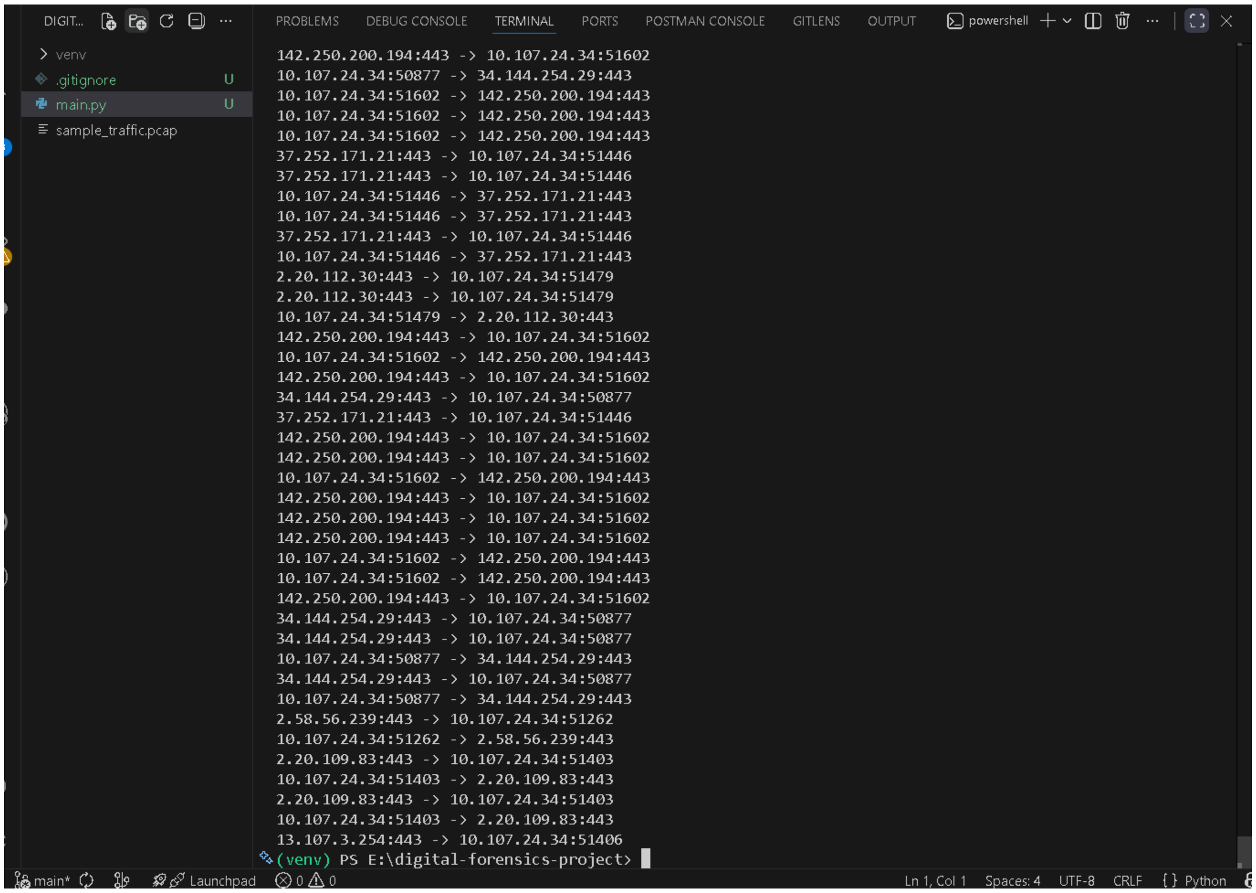
7. Results & Findings

7.1 DNS Findings

- All detected DNS queries are printed for inspection.
- The script does **not** automatically classify domains as malicious.
- Any suspicious behavior must be manually assessed based on:
    - Unknown domains
    - High-frequency queries
    - Unusual TLDs



```
142.250.200.194:443 -> 10.107.24.34:51602
10.107.24.34:50877 -> 34.144.254.29:443
10.107.24.34:51602 -> 142.250.200.194:443
10.107.24.34:51602 -> 142.250.200.194:443
10.107.24.34:51602 -> 142.250.200.194:443
37.252.171.21:443 -> 10.107.24.34:51446
37.252.171.21:443 -> 10.107.24.34:51446
10.107.24.34:51446 -> 37.252.171.21:443
10.107.24.34:51446 -> 37.252.171.21:443
37.252.171.21:443 -> 10.107.24.34:51446
10.107.24.34:51446 -> 37.252.171.21:443
2.20.112.30:443 -> 10.107.24.34:51479
2.20.112.30:443 -> 10.107.24.34:51479
10.107.24.34:51479 -> 2.20.112.30:443
142.250.200.194:443 -> 10.107.24.34:51602
10.107.24.34:51602 -> 142.250.200.194:443
142.250.200.194:443 -> 10.107.24.34:51602
34.144.254.29:443 -> 10.107.24.34:50877
37.252.171.21:443 -> 10.107.24.34:51446
142.250.200.194:443 -> 10.107.24.34:51602
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10.107.24.34:51602 -> 142.250.200.194:443
142.250.200.194:443 -> 10.107.24.34:51602
34.144.254.29:443 -> 10.107.24.34:50877
34.144.254.29:443 -> 10.107.24.34:50877
10.107.24.34:50877 -> 34.144.254.29:443
34.144.254.29:443 -> 10.107.24.34:50877
10.107.24.34:50877 -> 34.144.254.29:443
2.58.56.239:443 -> 10.107.24.34:51262
10.107.24.34:51262 -> 2.58.56.239:443
2.20.109.83:443 -> 10.107.24.34:51403
10.107.24.34:51403 -> 2.20.109.83:443
2.20.109.83:443 -> 10.107.24.34:51403
10.107.24.34:51403 -> 2.20.109.83:443
13.107.3.254:443 -> 10.107.24.34:51406
(venv) PS E:\digital-forensics-project>
```
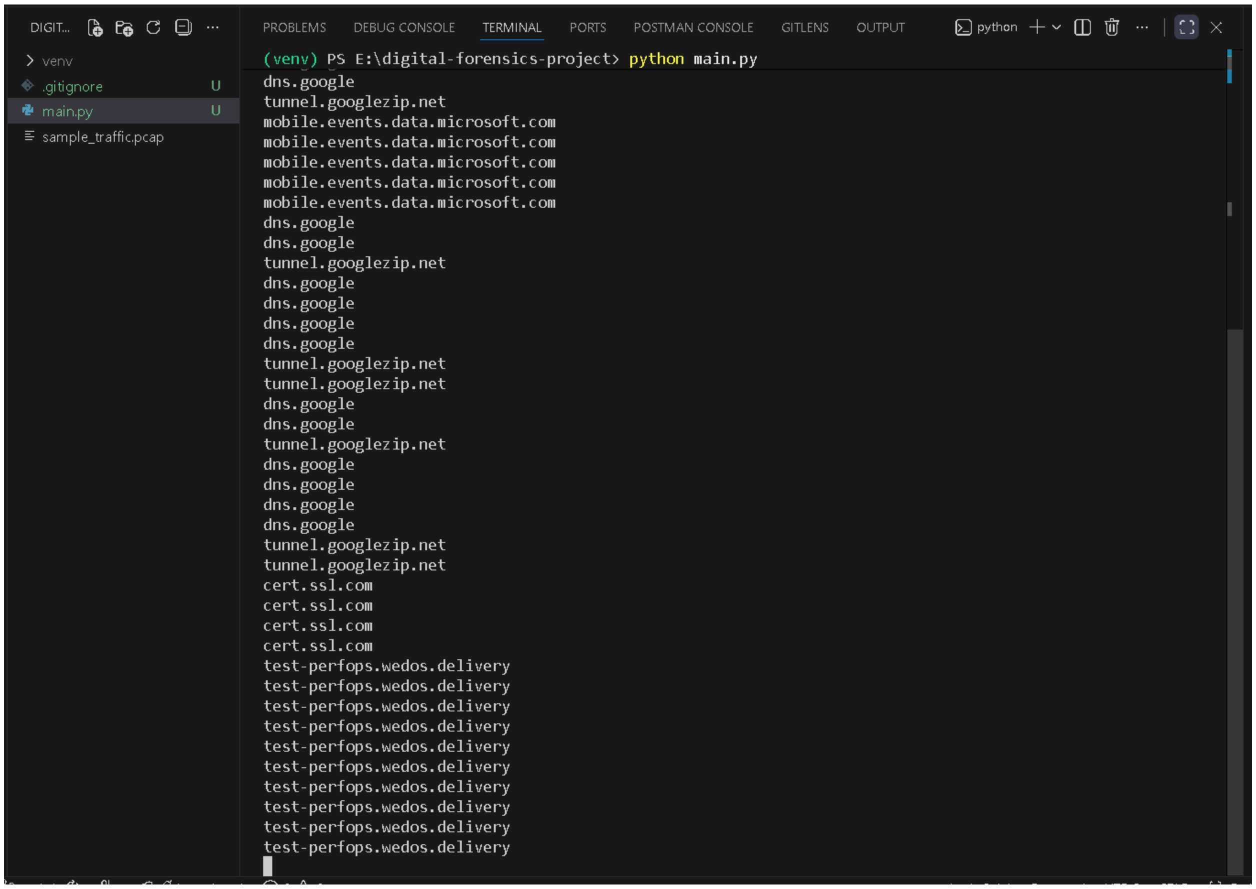

7.2 HTTP Findings

- HTTP requests are displayed in clear text.
- Reveals:
    - Request methods (GET, POST, etc.)
    - Target hosts
    - Requested resources

⚠️ **Security Note:**
The presence of HTTP traffic indicates **unencrypted communication**, which may expose credentials or sensitive data.



```
(venv) PS E:\digital-forensics-project> python main.py
dns.google
tunnel.googlezip.net
mobile.events.data.microsoft.com
mobile.events.data.microsoft.com
mobile.events.data.microsoft.com
mobile.events.data.microsoft.com
mobile.events.data.microsoft.com
dns.google
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tunnel.googlezip.net
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cert.ssl.com
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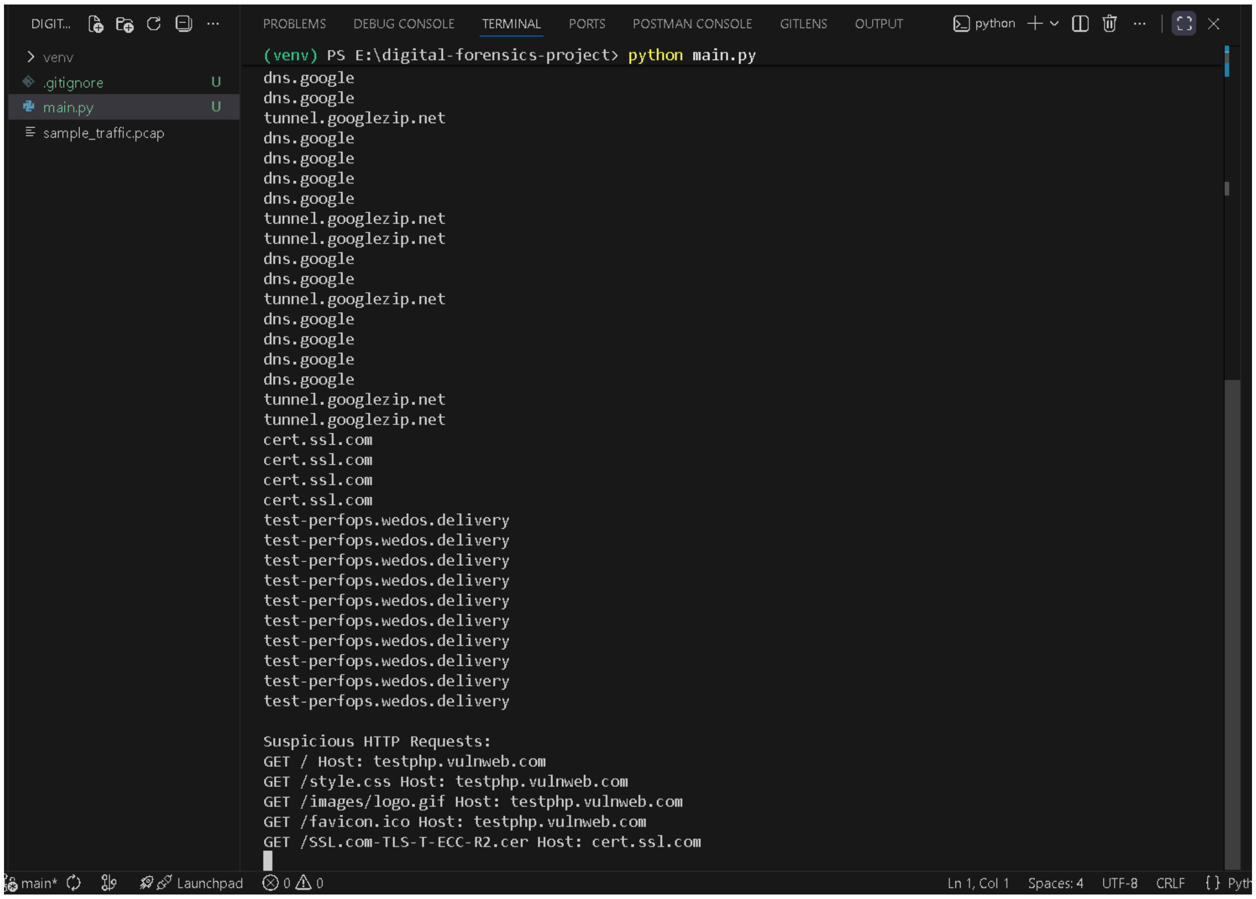
7.3 TCP Session Findings

- Displays all observed TCP communication paths.
- Useful for:
    - Mapping network activity

- ○ Identifying unexpected external connections
- ○ Detecting unusual port usage



```
(venv) PS E:\digital-forensics-project> python main.py
dns.google
dns.google
tunnel.googlezip.net
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dns.google
tunnel.googlezip.net
tunnel.googlezip.net
cert.ssl.com
cert.ssl.com
cert.ssl.com
cert.ssl.com
test-perfops.wedos.delivery
test-perfops.wedos.delivery
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test-perfops.wedos.delivery
test-perfops.wedos.delivery
test-perfops.wedos.delivery
test-perfops.wedos.delivery
test-perfops.wedos.delivery

Suspicious HTTP Requests:
GET / Host: testphp.vulnweb.com
GET /style.css Host: testphp.vulnweb.com
GET /images/logo.gif Host: testphp.vulnweb.com
GET /favicon.ico Host: testphp.vulnweb.com
GET /SSL.com-TLS-T-ECC-R2.cer Host: cert.ssl.com
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8. Limitations

- No automated threat intelligence or reputation checks.
- HTTPS traffic contents are not visible.
- No anomaly detection or behavior scoring.
- All results require **manual interpretation**.

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9. Conclusion

This script provides a **foundational approach to network traffic analysis** using Python and PyShark. It successfully extracts and presents DNS queries, HTTP requests, and TCP session data from a Wireshark-captured PCAP file.

While basic in nature, this approach is effective for:

- Educational purposes
- Initial forensic triage
- Understanding network behavior

Further enhancements could include:

- IOC matching
- HTTPS SNI extraction
- Statistical anomaly detection
- Exporting results to structured reports (JSON/CSV)
