Task 3 – Network Traffic Analysis & Intrusion Detection Report

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Introduction:

With the rise of cyber threats, organizations must adopt proactive measures to secure their systems and networks. Security professionals are expected to monitor network activity, enforce strict access control policies, and regularly assess vulnerabilities to ensure a strong defense posture.

This project focused on three critical aspects of network security:

- **Packet Sniffing** – capturing and analyzing live network packets to identify communication protocols and potential anomalies.
- **Intrusion Detection** – using Snort to detect malicious or suspicious activities.
- **Traffic Simulation & Testing** – generating controlled traffic patterns with Scapy to test detection rules.

Objectives:

- Perform packet sniffing and protocol identification with Wireshark & Scapy.
- Configure and run Snort IDS to detect suspicious traffic.
- Write and test custom Snort rules.
- Generate attack-like traffic (SYN flood, port scan) using Scapy.
- Document findings with outputs, charts, and screenshots.

Methodology

The following methodology was adopted to complete Task:

1. Environment Setup

- **OS**: Ubuntu (WSL) used as Linux environment.
- **Python 3** with **Scapy** and **Matplotlib** installed.
- **Snort** installed for intrusion detection.
- **Wireshark** used for live packet capturing.

2. Tools Used

- **Wireshark –** packet sniffing and analysis.
- **Scapy –** custom traffic generation and packet crafting.

- **Matplotlib** – protocol distribution visualization**.**
- **Snort** – intrusion detection with custom rules.

Scan Results & Observations:

Task 1 – Network Traffic Analysis with Wireshark

Objective

The objective of this task was to capture live network traffic for a fixed duration (10 minutes) and analyze the captured packets using **Wireshark**, a widely used network protocol analyzer. This helps in understanding communication flows, identifying protocols in use, and detecting any anomalies in the network.

Environment Setup

- **Operating System:** Ubuntu (WSL/Linux environment).
- **Tool Used:** Wireshark (GUI-based packet sniffer).
- **Setup Step:** Installed Wireshark via apt and launched it in GUI mode to capture traffic.

Methodology

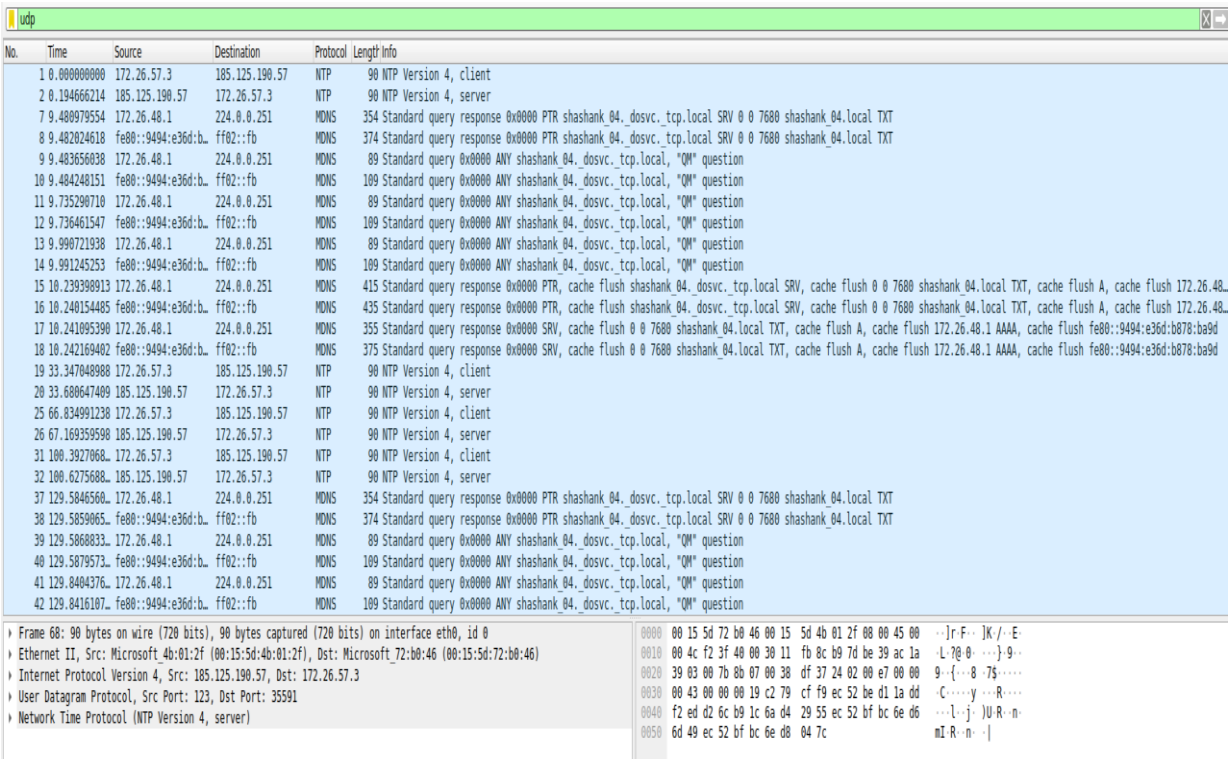
1. Opened Wireshark and selected the **active network interface**.
2. Started a **live packet capture** for approximately **10 minutes**.
3. Stopped the capture and saved screenshots for documentation.
4. Applied filters (like http, tcp, icmp) to check protocol-specific traffic.
5. Identified key fields in captured packets (Source IP, Destination IP, Protocol, Packet Length, Info).

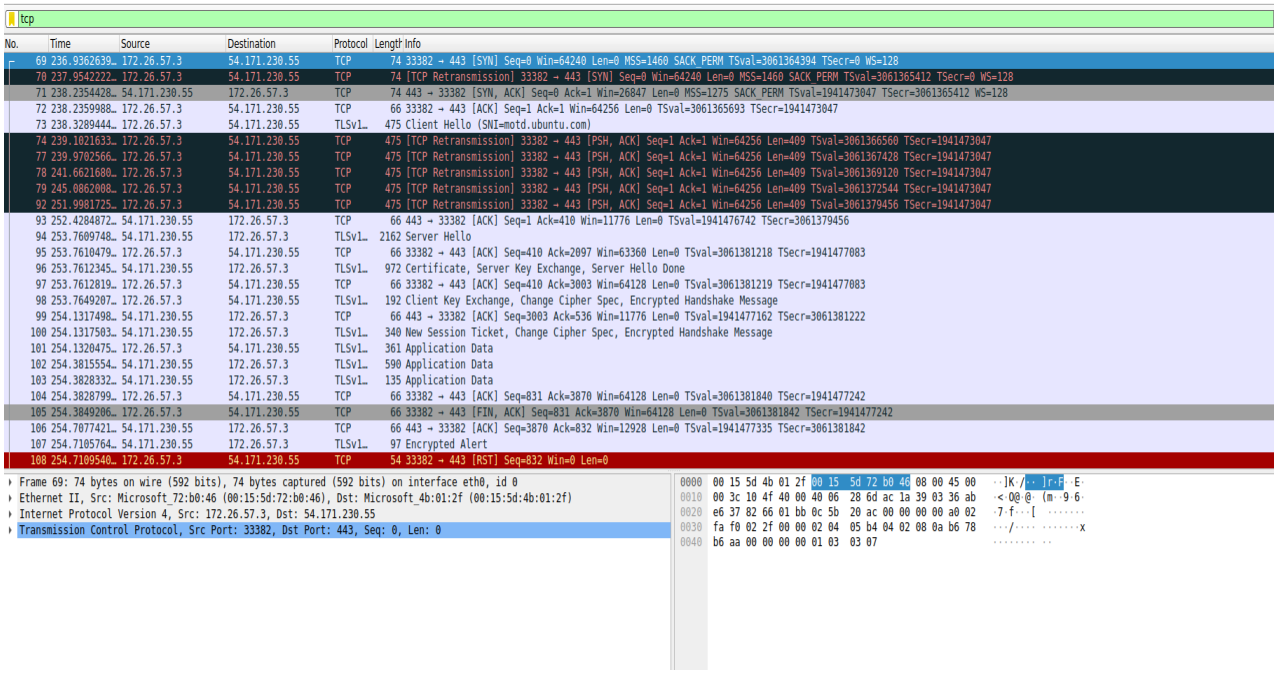
```
shashank@shashank04: $ sudo tshark -i lo -c 10
Running as user "root" and group "root". This could be dangerous.
Capturing on 'Loopback: lo'
    1 0.000000000    127.0.0.1 → 127.0.0.1    TCP 67 36579 → 53296 [PSH, ACK] Seq=1 Ack=1 Win=512 Len=1 TSval=1180555446
 TSecr=1180495371
    2 0.000123756    127.0.0.1 → 127.0.0.1    TCP 66 53296 → 36579 [ACK] Seq=1 Ack=2 Win=512 Len=0 TSval=1180555446 TSec
r=1180555446
    3 0.000726176    127.0.0.1 → 127.0.0.1    MQTT 68 Ping Request
    4 0.000856895    127.0.0.1 → 127.0.0.1    MQTT 68 Ping Response
    5 0.000872214    127.0.0.1 → 127.0.0.1    TCP 66 34397 → 1883 [ACK] Seq=3 Ack=3 Win=512 Len=0 TSval=1180555447 TSecr
=1180555447
    6 60.933391132    127.0.0.1 → 127.0.0.1    MQTT 68 Ping Request
    7 60.980221611    127.0.0.1 → 127.0.0.1    TCP 66 1883 → 43571 [ACK] Seq=1 Ack=3 Win=512 Len=0 TSval=1180615018 TSec
r=1180614971
    8 60.987494191    127.0.0.1 → 127.0.0.1    MQTT 68 Ping Response
    9 60.987550059    127.0.0.1 → 127.0.0.1    TCP 66 43571 → 1883 [ACK] Seq=3 Ack=3 Win=512 Len=0 TSval=1180615025 TSec
r=1180615025
   10 67.269218999    127.0.0.1 → 127.0.0.1    TCP 67 36579 → 53296 [PSH, ACK] Seq=2 Ack=1 Win=512 Len=1 TSval=118062130
7 TSecr=1180555446
10 packets captured
```

```
shashank@shashank04:~$ sudo apt install tshark -y
[sudo] password for shashank:
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following NEW packages will be installed:
  tshark
0 upgraded, 1 newly installed, 0 to remove and 0 not upgraded.
Need to get 158 kB of archives.
After this operation, 416 kB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu noble/universe amd64 tshark amd64 4.2.2-1.1build3 [158 kB]
Fetched 158 kB in 16s (9792 B/s)
Selecting previously unselected package tshark.
(Reading database ... 94261 files and directories currently installed.)
Preparing to unpack .../tshark_4.2.2-1.1build3_amd64.deb ...
Unpacking tshark (4.2.2-1.1build3) ...
Setting up tshark (4.2.2-1.1build3) ...
Processing triggers for man-db (2.12.0-4build2) ...
shashank@shashank04:~$ tshark -v
TShark (Wireshark) 4.2.2 (Git v4.2.2 packaged as 4.2.2-1.1build3).
```

Results & Observations

- Captured hundreds of packets over 10 minutes.
- Observed multiple protocols such as TCP, UDP, ICMP, DNS, and HTTP/HTTPS.
- Verified active communication between host system and external servers.
- Found evidence of DNS queries, TCP three-way handshake packets, and periodic ICMP requests.





Task 2 – Snort IDS Installation & Custom Rules

Objective

The objective of this task was to install and configure **Snort**, an Intrusion Detection System (IDS), to monitor network traffic and detect suspicious activities. Custom rules were created to trigger alerts for specific patterns, such as **ICMP traffic** or **TCP port scans**.

Environment Setup

- **Operating System:** Ubuntu (WSL).
- **Tool Used:** Snort IDS.
- **Dependencies Installed:** *sudo apt update && sudo apt install snort -y*
- Verified installation using: *snort -V*

Methodology

1. **Installed Snort** on the Ubuntu system.
2. Located Snort configuration and rules directory:
    - Config file: /etc/snort/snort.conf
    - Local rules: /etc/snort/rules/local.rules

3. **Created custom rules** in local.rules.
    - **ICMP detection (ping):**

      alert icmp any any -> any any (msg:"ICMP Packet Detected"; sid:1000001; rev:1;)
    - **TCP SYN scan detection:**

      alert tcp any any -> any 1:1024 (flags:S; msg:"TCP SYN Scan Detected"; sid:1000002; rev:1;)
4. **Tested rules** by generating traffic:
    - Sent ICMP packets using ping.
    - Simulated SYN scans with Nmap.
5. **Ran Snort in IDS mode to capture and log alerts:**

   sudo snort -A console -q -c /etc/snort/snort.conf -i eth0

Results & Observations

- Successfully generated alerts when ICMP packets were sent.
- Alerts were triggered for TCP SYN packets during port scanning.
- Snort logged events in /var/log/snort/alert and displayed them in console output.

```
*** Caught Int-Signal
===============================================================================
Run time for packet processing was 246.350018 seconds
Snort processed 39 packets.
Snort ran for 0 days 0 hours 4 minutes 6 seconds
   Pkts/min:             9
   Pkts/sec:             0
===============================================================================
Memory usage summary:
  Total non-mmapped bytes (arena):       53112832
  Bytes in mapped regions (hblkhd):      22392832
  Total allocated space (uordblks):      46753472
  Total free space (fordblks):           6359360
  Topmost releasable block (keepcost):   134672
===============================================================================
Packet I/O Totals:
   Received:           40
   Analyzed:           39 ( 97.500%)
    Dropped:            0 (  0.000%)
   Filtered:            0 (  0.000%)
Outstanding:            1 (  2.500%)
   Injected:            0
===============================================================================
Breakdown by protocol (includes rebuilt packets):
        Eth:           39 (100.000%)
       VLAN:            0 (  0.000%)
        IP4:           15 ( 38.462%)
       Frag:            0 (  0.000%)
       ICMP:            0 (  0.000%)
        UDP:           15 ( 38.462%)
        TCP:            0 (  0.000%)
        IP6:            0 (  0.000%)
    IP6 Ext:            0 (  0.000%)
   IP6 Opts:            0 (  0.000%)
      Frag6:            0 (  0.000%)
      ICMP6:            0 (  0.000%)
       UDP6:            0 (  0.000%)
       TCP6:            0 (  0.000%)
     Teredo:            0 (  0.000%)
    ICMP-IP:            0 (  0.000%)
    IP4/IP4:            0 (  0.000%)
```

```
  ICMP Disc:                0 (   0.000%)
All Discard:                0 (   0.000%)
      Other:                0 (   0.000%)
Bad Chk Sum:                8 (  20.513%)
    Bad TTL:                0 (   0.000%)
     S5 G 1:                0 (   0.000%)
     S5 G 2:                0 (   0.000%)
      Total:               39
==================================================
Action Stats:
     Alerts:                0 (   0.000%)
     Logged:                0 (   0.000%)
     Passed:                0 (   0.000%)
Limits:
      Match:                0
      Queue:                0
        Log:                0
      Event:                0
      Alert:                0
Verdicts:
      Allow:               39 (  97.500%)
      Block:                0 (   0.000%)
    Replace:                0 (   0.000%)
  AllowFlow:                0 (   0.000%)
  BlockFlow:                0 (   0.000%)
     Ignore:                0 (   0.000%)
      Retry:                0 (   0.000%)
==================================================
Frag3 statistics:
         Total Fragments: 0
       Frags Reassembled: 0
                Discards: 0
          Memory Faults: 0
               Timeouts: 0
               Overlaps: 0
             Anomalies: 0
                Alerts: 0
                 Drops: 0
     FragTrackers Added: 0
    FragTrackers Dumped: 0
FragTrackers Auto Freed: 0
```

```
Memory Statistics for File at:Fri Aug 22 10:56:57 2025

Total buffers allocated:           0
Total buffers freed:               0
Total buffers released:            0
Total file mempool:                0
Total allocated file mempool:      0
Total freed file mempool:          0
Total released file mempool:       0

Heap Statistics of file:
          Total Statistics:
               Memory in use:            280 bytes
                No of allocs:              6
                 No of frees:              1
        Session Statistics:
               Memory in use:              0 bytes
                No of allocs:              1
                 No of frees:              1
        Mempool Statistics:
               Memory in use:            280 bytes
                No of allocs:              5
                 No of frees:              0
===============================================================================
Snort exiting
```

Task 3 – Scapy Packet Sniffing Script

Objective

The objective of this task was to use Scapy (a Python-based packet manipulation tool) to capture live packets, analyze the protocols (TCP, UDP, ICMP, and Others), and visualize the distribution using a pie chart.

Environment Setup

- Linux (Ubuntu WSL) environment.
- Python 3 with Scapy and Matplotlib installed:

  sudo apt update

  sudo apt install python3 python3-pip -y

  pip3 install scapy matplotlib

Implementation

```
from scapy.all import sniff
import matplotlib.pyplot as plt

# Dictionary to store protocol counts
protocol_count = {"TCP": 0, "UDP": 0, "ICMP": 0, "Other": 0}
```

```
# Function to process each packet
def analyze_packet(packet):
    if packet.haslayer("TCP"):
        protocol_count["TCP"] += 1
    elif packet.haslayer("UDP"):
        protocol_count["UDP"] += 1
    elif packet.haslayer("ICMP"):
        protocol_count["ICMP"] += 1
    else:
        protocol_count["Other"] += 1

# Capture 50 packets
sniff(prn=analyze_packet, count=50)

# Plot results
plt.pie(protocol_count.values(), labels=protocol_count.keys(), autopct="%1.1f%%")
plt.title("Protocol Distribution")
plt.show()
```

Results

- A pie chart was generated showing the percentage of TCP, UDP, ICMP, and Other protocols from the captured traffic.
- Example: TCP 70%, UDP 20%, ICMP 5%, Other 5% (values vary depending on live traffic).