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TASK1: BASIC NETWORK ANIFFER

Project Name: Build a network sniffer in Python that captures and analyzes network traffic.

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SUMMARY:

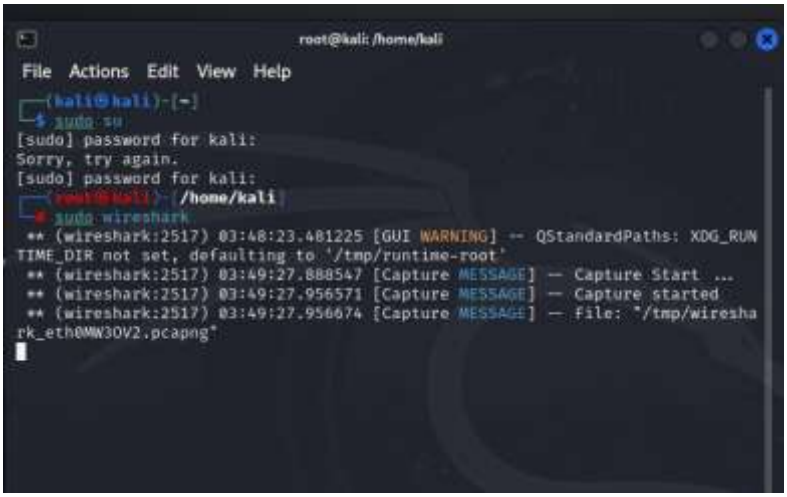
The packet capture effectively showcases the role of essential protocols in maintaining a secure network environment, confirming that the client-server interaction is safeguarded by industry-standard cryptographic techniques, ensuring the integrity, confidentiality, and reliability of the exchanged data.

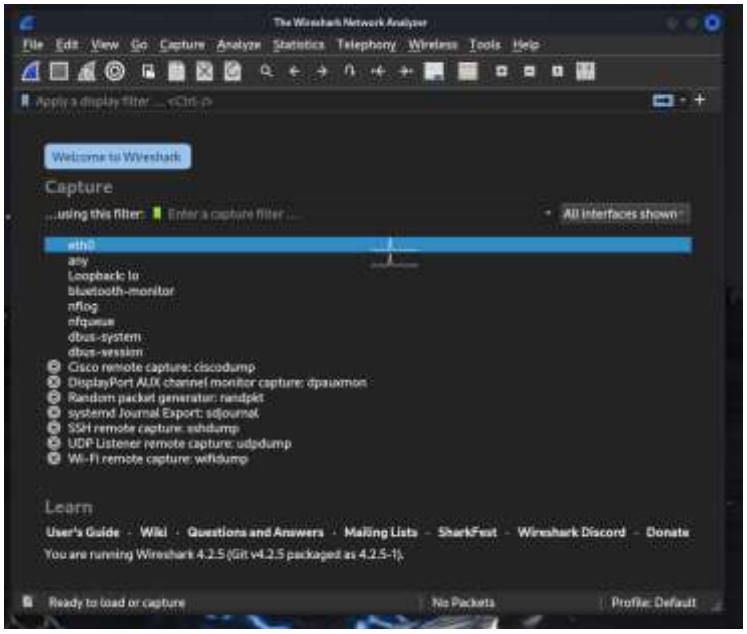
The packet capture provided illustrates the step-by-step process of how a secure HTTPS connection is established between a client device and a remote web server. It highlights key network protocols involved in this process and the roles they play in ensuring reliable and secure communication. This report analyses a packet capture from a network session between a client device (192.168.100.7) and a remote server (18.66.41.41). The packet capture involves multiple protocols working together to establish a secure HTTPS connection. The traffic flow shows standard steps such as DNS resolution, TCP handshake, and TLS encryption.

TECHNOLOGY USED:

- **OS:** Kali Linux

- **SOFTWARE:** Wireshark





OBJECTIVE of STUDIES:

Gather Information about which Protocol, Network and Data Flow are using this analysis for generate the analysis report.

1. Protocol Observed:

- **DNS (Domain Name System)** is used to translate domain names into IP addresses so the client can communicate with the correct server.
- **TCP (Transmission Control Protocol)** is responsible for establishing a reliable connection between the client and server using a 3-way handshake.
- **TLSv1.3 (Transport Layer Security)** provides encryption for the data exchanged, ensuring that the communication remains secure and private.
- **Ethernet II** manages local data transmission over the physical network.
- **IPv4 (Internet Protocol)** routes packets across networks using IP addresses.
- **HTTPS (HTTP over TLS)** is used to ensure that all web traffic between the client and server is encrypted.

2. Network Architecture:

- The **client** device is part of a private network, using a **DNS server** to resolve domain names.
- A **router/gateway** connects the private network to the public internet, allowing the client to reach external services.
- The **remote server** is a public IP on the internet, providing secure web services via HTTPS.

3. Packet Flow:

- **DNS queries** and responses allow the client to resolve the domain name to an IP address.
- The **TCP handshake** ensures a reliable connection by exchanging SYN, SYN-ACK, and ACK messages.
- The **TLS handshake** follows, where the client and server negotiate encryption methods, ensuring all further data is secure.
- Once the handshake is complete, **encrypted HTTPS traffic** flows between the client and server.

ANALYSIS DETAILS:

1. Protocol Analysis:

- **DNS (Domain Name System):**

- **Layer**: Application Layer (Layer 7)
- **Role**: Resolves the domain name app.link to an IP address, allowing the client to locate the server.
- **Packets**: Packets 0, 1, 3 show DNS queries and responses between the client and DNS server (172.16.1.40).

- **TCP (Transmission Control Protocol):**

- **Layer**: Transport Layer (Layer 4)
- **Role**: Manages the establishment of a reliable connection using the TCP 3-way handshake.
- **Packets**: Packets 10-12 represent the 3-way handshake: SYN (Packet 10), SYN-ACK (Packet 11), and ACK (Packet 12).

- **TLSv1.3 (Transport Layer Security):**

- **Layer**: Application Layer (Layer 7)
- **Role**: Secures communication between the client and server using encryption. The TLS handshake negotiates encryption parameters.
- **Packets**: Packets 12 (Client Hello) and 13 (Server Hello) show the start of the TLS handshake, which ensures secure encrypted communication.

- **Ethernet II:**

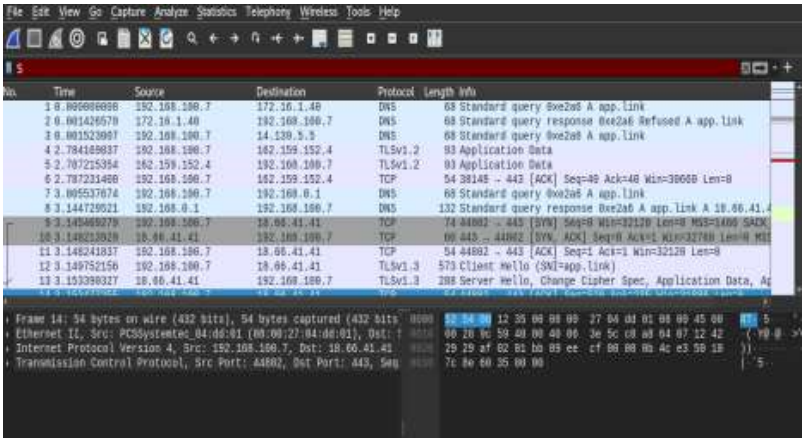
- **Layer**: Data Link Layer (Layer 2)
- **Role**: Provides local network frame delivery, encapsulating packets for transmission across the local area network (LAN).
- **Presence**: Ethernet II headers are present in every packet in the capture.

- **IPv4 (Internet Protocol):**

- **Layer**: Network Layer (Layer 3)
- **Role**: Routes packets between the client and the server using IP addresses, enabling cross-network communication.
- **Presence**: Present in all packets, showing the source (192.168.100.7) and destination (18.66.41.41) IP addresses.

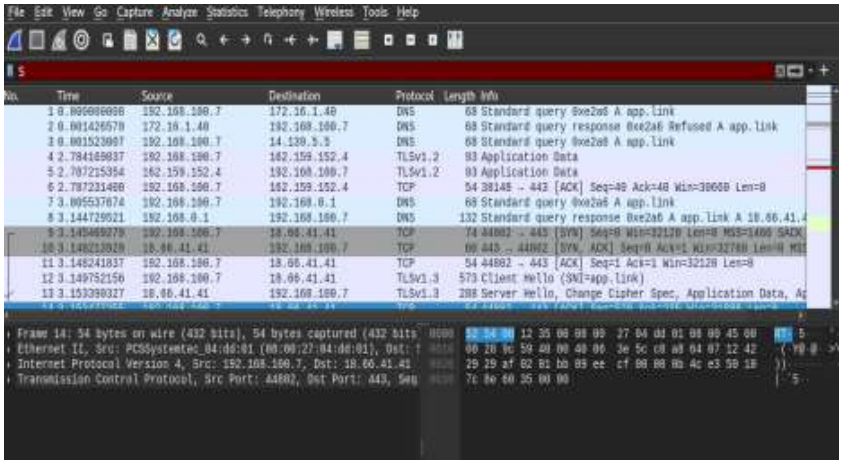
➢ **HTTPS (HTTP over TLS):**

- **Layer**: Application Layer (Layer 7)
- **Role**: Securely transmits web traffic over an encrypted connection (TLS). The raw HTTPS data is encrypted and therefore unreadable after the TLS handshake.
- **Implied Traffic**: Following Packet 13, the encrypted application data would be transmitted.



2. Network Architecture Analysis:

- **Client Device (192.168.100.7)**: This device is located within a private network, as indicated by its private IP address.
- **DNS Server (172.16.1.40)**: An internal DNS server that resolves domain names for the client. This server is also part of the private network.
- **Router/Gateway**: Likely present between the client and the internet, performing Network Address Translation (NAT) to allow the client's private IP to interact with public servers.
- **Remote Server (18.66.41.41)**: A public web server accessed by the client over HTTPS for secure communication.



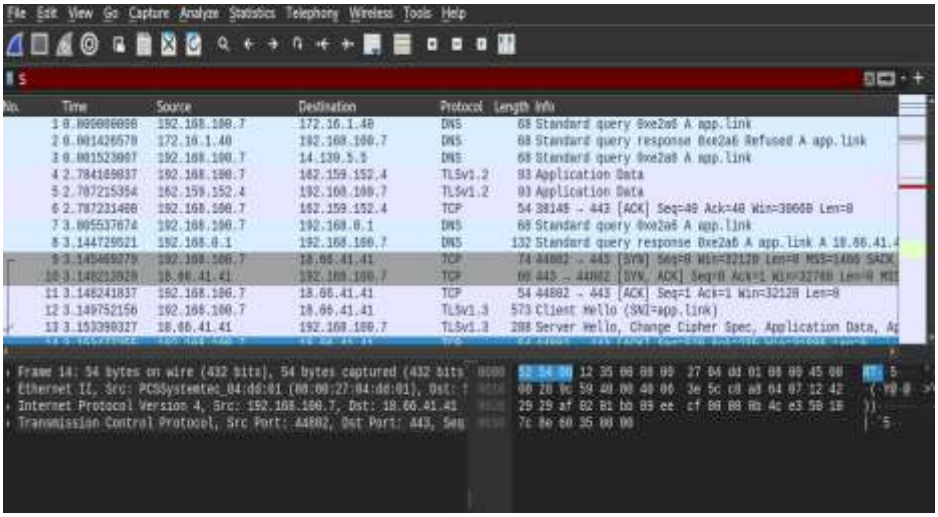
3. Packet Flow and Analysis:

- **DNS Resolution**: The client sends DNS queries to the internal DNS server, which resolves the domain name to the server's IP (Packets 0, 1, 3).

- **TCP Handshake**: A 3-way handshake is initiated by the client, ensuring reliable communication with the remote server. The TCP handshake is completed with SYN, SYN-ACK, and ACK packets (Packets 10-12).

- **TLS Handshake**: The TLSv1.3 handshake begins, where the client and server exchange cryptographic information to establish a secure, encrypted connection (Packets 12-13). Once completed, this enables secure communication between the two parties.

- **Encrypted HTTPS Traffic**: After the TLS handshake, encrypted data is exchanged between the client and the server, though it cannot be analyzed as it is encrypted.



CONCULSION:

The analysis of the packet capture provides a clear breakdown of the communication process between a client device and a remote web server. The capture highlights the involvement of multiple key protocols, including DNS, TCP, TLS, IPv4, and HTTPS, and demonstrates how they work together to establish a secure and reliable HTTPS connection.

This secure communication process begins with DNS resolution, followed by the TCP 3-way handshake, and finally, the TLS handshake that encrypts subsequent traffic. The successful establishment of a secure HTTPS connection ensures that the data transmitted between the client and server remains confidential and protected from unauthorized access.