CS471 – Web Technologies (Laboratory)		Lab 1
		The Internet Protocols

This lab session covers the usage of the Wireshark application to monitor and capture the outgoing and incoming packets from a network connection (WIFI, ethernet, etc.). Specifically, students should be able to analyze HTTP, HTTPS, TCP/IP, and UDP protocols using Wireshark, a network protocol analyzer, and draw conclusions.

Pre-lab Preparation:

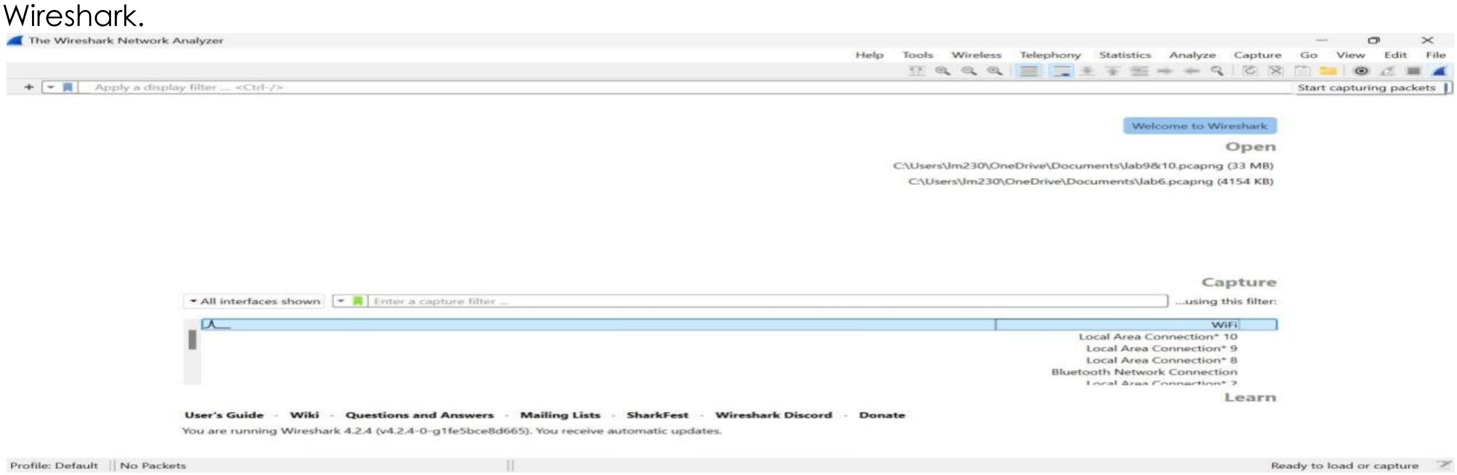
1. Review the basics and the structure of HTTP, TCP/IP, and UDP protocols,
2. Install Wireshark and ensure it is running on your computer,
3. Create an online, *publically accessible* Git repository to host and upload your work in the labs. We recommend you use GitHub or GitLab.

Lab Activities:

Part 1: Capturing HTTP Traffic.

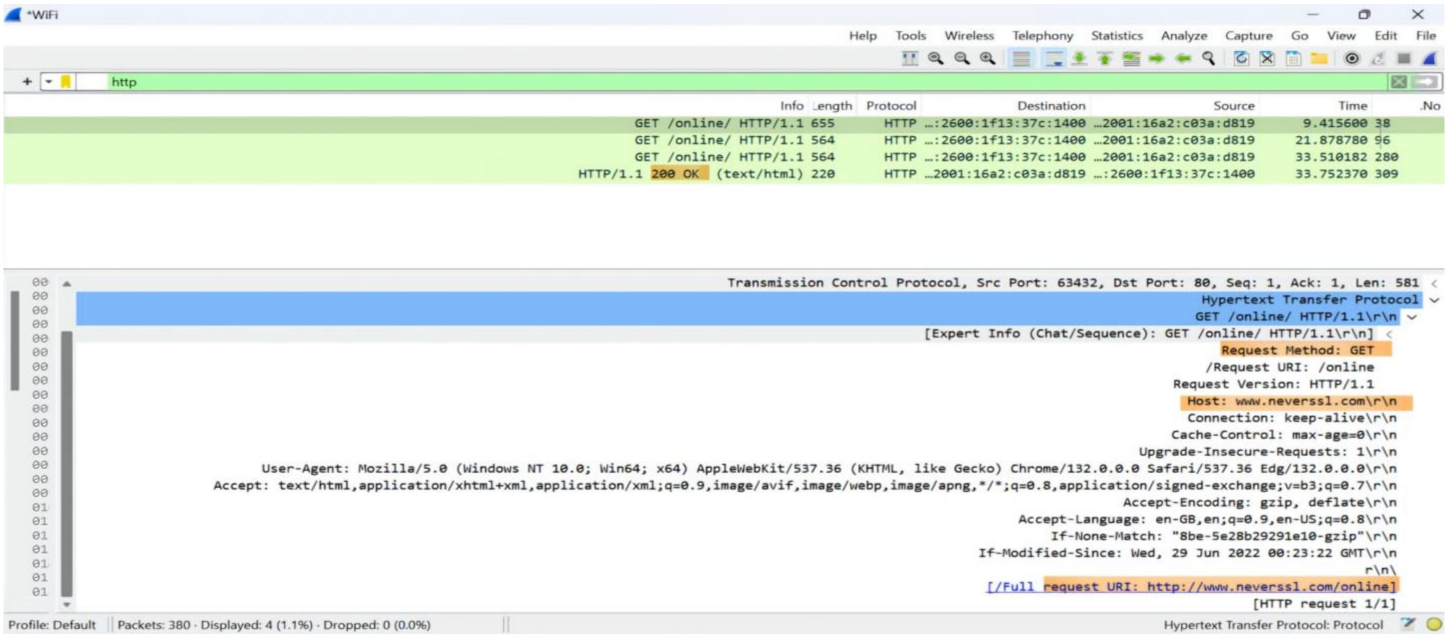
Task 1: Start Wireshark and capture packets.

Step 1: Open Wireshark.
Step 2: Select the network interface connected to the internet (e.g., Ethernet or Wi-Fi).
Step 3: Click the "Start Capturing Packets" button (the shark fin icon).
Step 4: Open your favorite web browser and navigate to (http://neverssl.com/) website.
Step 5: After the website has fully loaded, stop capturing packets by clicking the red stop button in Wireshark.



Task 2: Filter HTTP packets and analyze them.

Step 1: In the filter bar, type http and press Enter. This filters out only the HTTP packets from the capture.
Step 2: Select any HTTP packet to view its details.
Step 3: Observe the HTTP request and response messages. Note the method (GET, POST), URL, response codes (200 OK, 404 Not Found), etc.



Request Method : GET

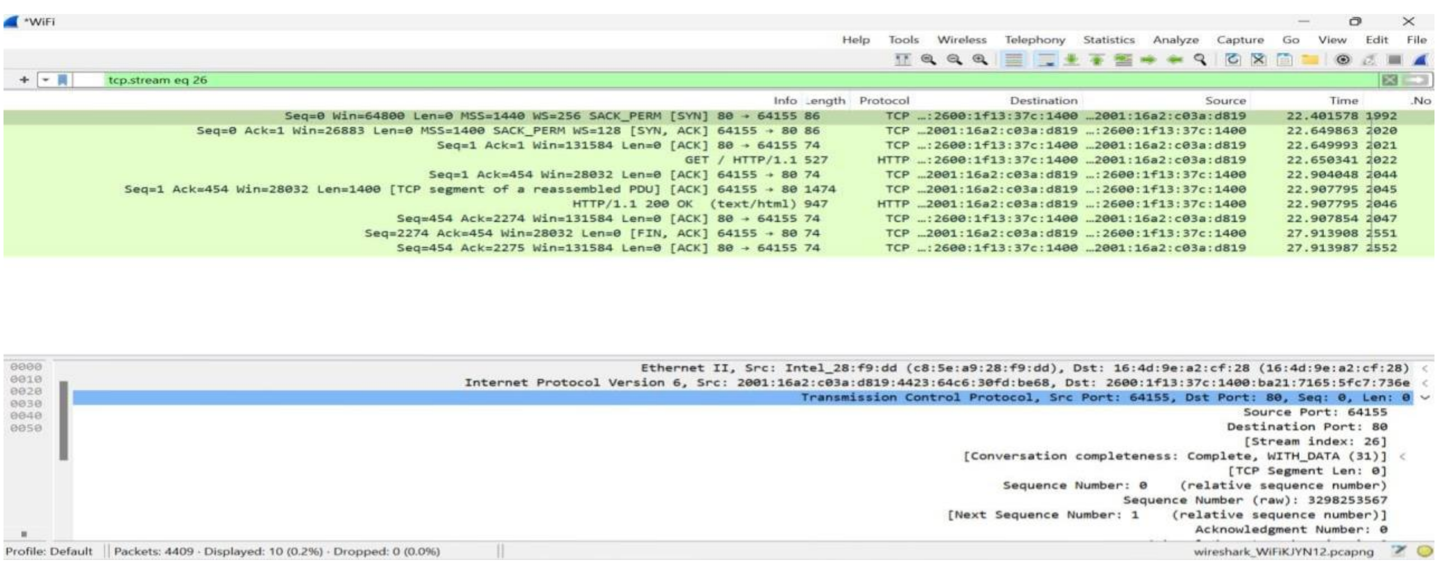
Request URL : http://www.neverssl.com/online

Response Method : 200 OK

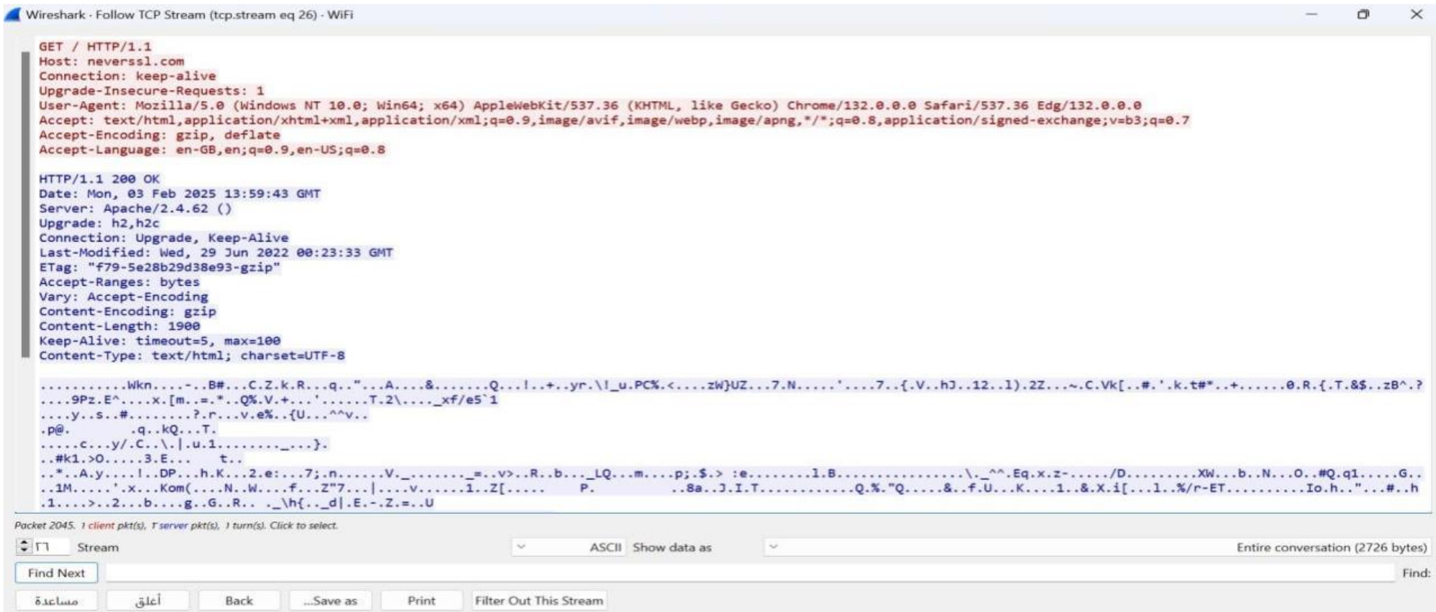
Part 2: Analyzing TCP/IP Traffic.

Task 1: Filter TCP packets

Step 1: Clear the previous filter and type TCP to focus on TCP packets.
Step 2: Select a TCP packet related to your HTTP request/response.



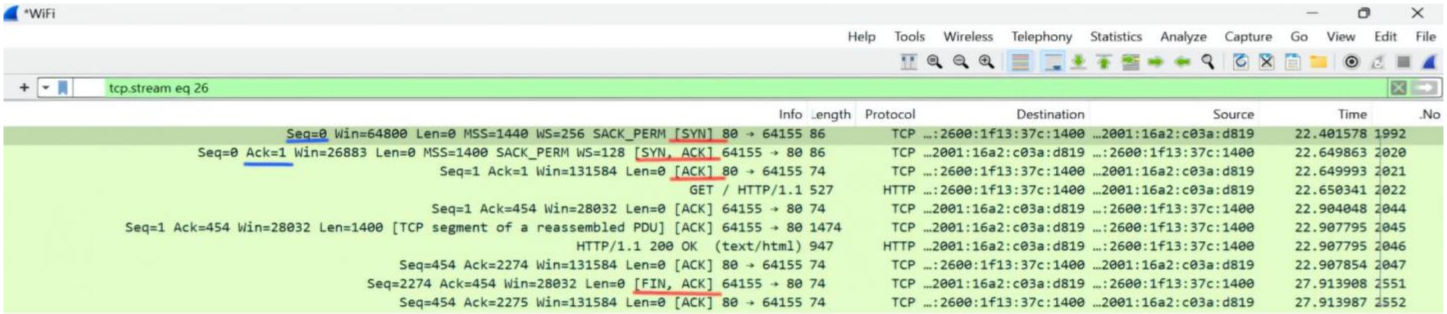
Step 3: Right-click on the packet and select "Follow" -> "TCP Stream".
Step 4: This shows the entire conversation between the client and server.

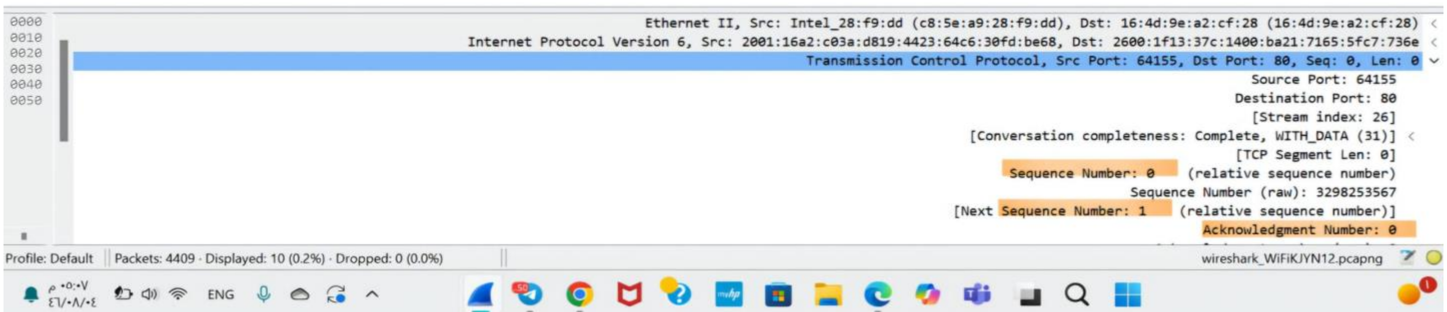


Task 2: Analyze TCP handshake and investigate Data Transfer and Termination
Step 1: Find and select packets related to the TCP three-way handshake:

- SYN: Initiates a connection.
- SYN-ACK: Acknowledges and responds to the SYN.
- ACK: Acknowledges the SYN-ACK and establishes the connection.

Step 2: Note the sequence and acknowledgment numbers. Screenshot and upload your image to your online git repository.
Step 3: Observe the data packets exchanged between the client and server. Take a screenshot and upload it to your online git repo.
Step 4: Look at the TCP termination process (FIN, ACK packets).



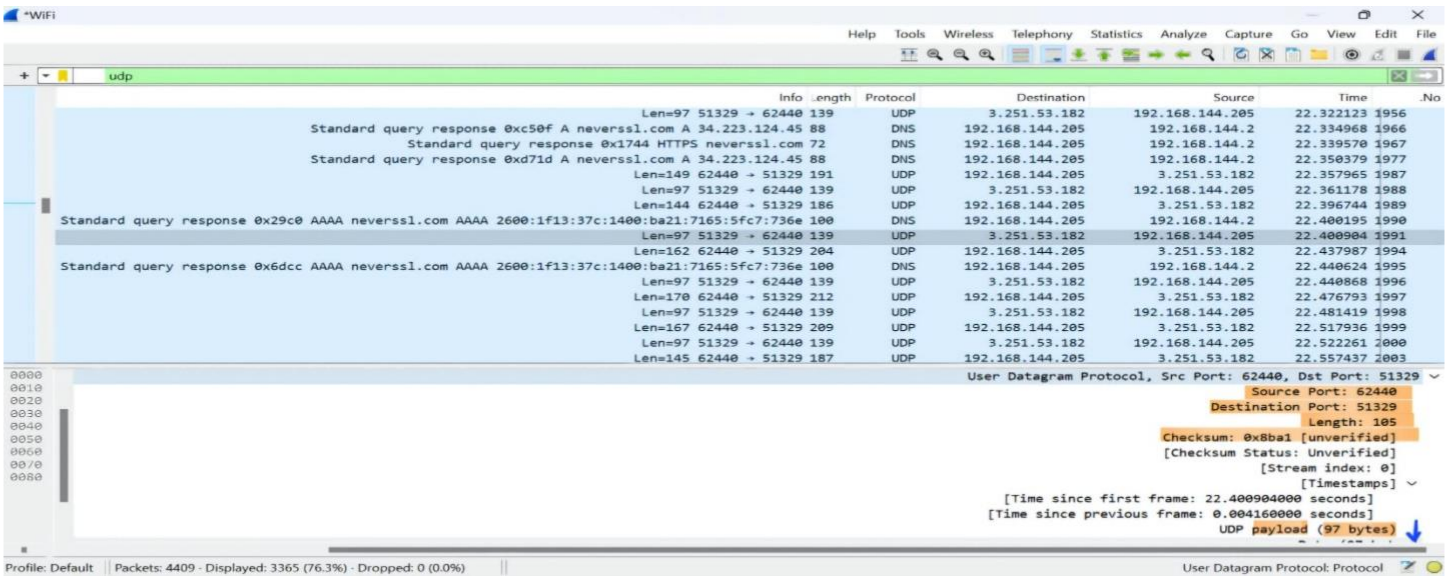


Part 3: Capturing and Analyzing UDP Traffic

Task 1: Generate UDP traffic and capture packets

Step 1: Open a network application that uses UDP (e.g., streaming video, VoIP software, or custom script).
Step 2: Start the application to generate UDP traffic.
Step 3: Start capturing packets in Wireshark while the UDP application is running.
Step 4: After sufficient traffic is generated, stop capturing packets.

Task 2: Filter and analysis UDP Packets
Step 1: In the filter bar, type UDP and press Enter.
Step 2: This filters out only the UDP packets from the capture.
Step 3: Select any UDP packet to view its details.
Step 4: Observe the source and destination ports, length, and data.



Data : 97 bytes.

Step 5: Compare the simplicity of UDP headers with TCP headers.

TCP header (20-60 bytes): include Source Port, Destination Port, Sequence Number, Acknowledgment Number, Header Length, Flags (Control Bits: Includes SYN, ACK, FIN, RST, PSH, and URG),Window Size, Checksum, Urgent Pointer, and Options.

UDP header (8 bytes): include Source Port ,Destination Port , Length ,Checksum**.**

Part 4: Comparing TCP and UDP by filling in the following tables. Save your work (e.g., in an MS Word document), and upload it to your online git repo.

Task 1: Fill in the following table and provide reasons.

	TCP or UDP	Reasons
Reliability and Connection Establishment	TCP	TCP is connection-oriented and establishes a connection using a three-way handshake (SYN, SYN-ACK, ACK) before data transfer. It ensures data delivery and retransmits lost packets.
Data Integrity and Ordering	TCP	TCP ensures data integrity with a checksum and maintains the correct order of packets using sequence numbers. It also uses acknowledgments (ACKs) to confirm packet delivery.

Task 2: Identify the use Cases and Performance of TCP and UDP.

	TCP	UDP
Use cases	- Web Browsing (HTTP/HTTPS) - Email Services (SMTP, IMAP, POP3) - File Transfers (FTP, SFTP) - Remote Access (SSH, Telnet) - Database Communication (MySQL, PostgreSQL)	- Streaming Media (YouTube, Netflix) - Online Gaming (low-latency multiplayer) - Voice and Video Calls (VoIP, Zoom, Skype) - DNS Lookups - IOT Communication (sensors, smart devices)
Performance	- Reliable but slower due to connection setup (3-way handshake) - Ensures data integrity and packet ordering - Supports error correction and retransmission - Higher network overhead due to control mechanisms	- Faster, low latency due to no connection setup - No error correction or packet ordering (packets may arrive out of order) - Ideal for real-time communication - Lower network overhead and efficient bandwidth usage