TCP Project Report

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Project Title: TCP Segment Visualizer with RTT and Timeout Analysis

Abstract

This project aims to develop a TCP Segment Visualizer that enables users to upload a Wireshark (`.pcap`) file and analyze TCP segments. The tool will extract Round-Trip Time (RTT), Timeout Interval, and Receiver Window (RWND) values from the captured data and present them in a graphical format over time. The Graphical User Interface (GUI) will provide an interactive way to view the TCP header structure, monitor key TCP parameters, and analyze network performance efficiently.

Features

- **Import `.pcap` files to examine TCP segments**
- **Extract and display TCP headers visually**
- **Compute and plot Round-Trip Time (RTT) dynamically**
- **Track and display timeout interval trends**
- **Monitor Receiver Window (RWND) variations over time**

Required Python Modules

Packet Analysis

- **`scapy` – Extract TCP elements from Wireshark `(.pcap)` files**
- **`pyshark` – Alternative packet capture parser**

Data Handling

- **`pandas` – Manage and manipulate TCP segment data**
- **`numpy` – Perform numerical calculations**

Visualization & GUI

- **`tkinter` – Create the desktop GUI**
- **`matplotlib` – Generate and display graphs for RTT, timeout, and RWND**

Network Calculations and Timing

- **`time` – Measure RTT values**
- **`statistics` – Compute averages and standard deviations**

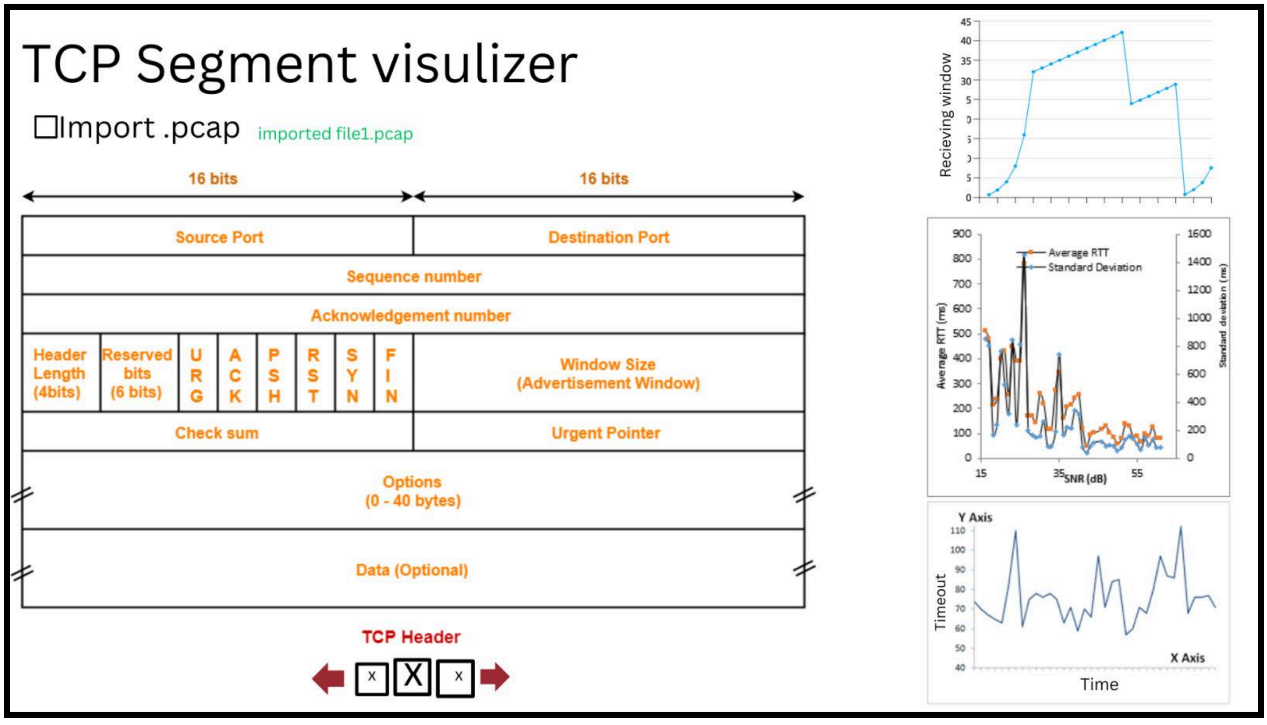
Implementation Steps

1. **Extract TCP segments from the uploaded `.pcap` file.**
2. **Parse TCP headers to obtain sequence numbers, ACKs, and RWND values.**
3. **Calculate RTT using SYN-ACK and ACK pairs.**
4. **Determine timeout intervals based on TCP retransmission timeouts (RTO).**
5. **Visualize RWND, RTT, and timeout interval changes over time.**
6. **Develop a GUI to display TCP headers and graphs interactively.**

Expected Output

- **Graphical representation of the TCP header structure**
- **Graph displaying RTT variations over time**
- **Graph tracking timeout intervals**
- **Graph illustrating RWND fluctuations**

Graphical User Interface (GUI)



Conclusion

This project provides an intuitive way to analyze TCP behaviour using packet captures. By visualizing RTT, timeout intervals, and RWND fluctuations, users can gain insights into network congestion, flow control mechanisms, and TCP performance.