

TCP/IP Simulator Project Report Final Submission

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Introduction

This simulation is a tool designed to simulate TCP/IP networks, offering users a comprehensive way to explore networking concepts and protocols. From designing custom network topologies to simulating data transmission, the application provides a practical and educational platform for understanding TCP/IP networks.

Key Features

- **Topology Design:**

Users can create custom network topologies. Network components like endpoints (stations/devices), switches, and routers can be added, connected, and configured to design the ideal network layout.

- **Network Components:**

The application features a wide range of network components, including endpoints (stations/devices), switches, hubs, and bridges, simulating real-world networking devices and their functionalities.

- **Encoding and Decoding:**

Data is shared between devices in the form of bits, transmitted in a specific frame size (set to 8 in this simulation).

- **Access Control:**

The CSMA - CD(Carrier Sense Multiple Access - Collision Detection) protocol is implemented, allowing devices to exchange data only when the medium is free or idle. If the medium is busy, other stations are prevented from transmitting data.

- **Error Control:**

A simple parity check (even parity) is implemented for error control. If an error is detected in a frame, it is discarded, and no acknowledgment (ACK) is sent for that frame.

- **Flow Control:**

Whenever a frame is received, an ACK is sent back to the sender, ensuring that the frame has been successfully received without errors.

- **Application Layer:**

Two services, ping and file transfer, are implemented, allowing the creation of messages.

- **Transport Layer:**

Port numbers are assigned, and segments are created.

- **Network Layer:**

A routing table is maintained, IP addresses are assigned to devices, and packets are created.

- **Data Link Layer:**

MAC addresses are assigned, an ARP table is maintained, frames are created, ACKs are generated, error control (parity check) is implemented, and an access control protocol (CSMA/CD) is employed.

- **Physical Layer:**

Connections can be added and removed.

- **Graphical User Interface (GUI):**

The application features a user-friendly GUI developed using the Tkinter library, allowing users to interact with the simulation and visualize the network topology and connections.

Conclusion

The TCP/IP Simulator offers a practical and educational platform for understanding TCP/IP networks and related concepts. By providing users with tools to design, simulate, and analyze networks, the application enhances learning and experimentation in the field of networking.

Tools Used

- Python
- Tkinter library
- Matplotlib library

How to Run the Script

1. Clone the codebase to your local device by downloading the files from the ZIP file.
2. Install the required libraries: Tkinter (`pip3/pip install tkinter`) and matplotlib (`pip3/pip install matplotlib`).
3. Run the command `python3 main.py` in the terminal.

References

- Tkinter official documentation
- Matplotlib library documentation
- Python documentation
- Claude by Anthropic
- Class notes
- Cisco Packet Tracer