CS 356- Computer Network Lab

Lab Assignment 7

Q1. Enhanced Multi-Node Topology with Error Model and Multiple UDP Flows

Extend the basic three-node topology (which you had created in the previous Assignment Question 1) to a four-node topology by adding an extra node (Node3) between the current Node2 and the destination. Connect the nodes using point-to-point links as follows:

- **Topology:** Node0 → Node1 → Node2 → Node3

- **Error Model:** Introduce an error model (e.g., a specified packet error rate) on one of the links (for instance, between Node1 and Node2).

- **Applications:**

  ○ Set up two UDP client-server pairs using different port numbers. For example, one client-server pair communicates between Node0 and Node2, and another between Node0 and Node3.

  1. **Simulate and capture network traffic using pcap.**

  2. **Analyze the end-to-end throughput and packet delivery performance under different link delays and error conditions.**

  3. **Discuss how the introduction of an error model impacts the overall network performance.**

Q2. Concurrent UDP and TCP Flow Analysis

Modify the simulation to incorporate both UDP and TCP flows within a single network scenario. Use a topology with at least three nodes connected via point-to-point links.

- **Setup:**

  ○ Configure a UDP client-server pair on one set of nodes.

  ○ Configure a TCP client-server pair on another set of nodes.

- **Experimentation:**

    ○ Vary network parameters such as data rate and link delay.

    ○ Simulate the network and capture the traffic using pcap and flow monitoring tools.

1. **Compare the performance metrics (throughput, delay, and packet loss) between UDP and TCP flows.**

2. **Analyze how TCP's congestion control mechanism adapts to network conditions compared to the UDP flow which lacks congestion control.**

3. **Provide insights into the different behaviors and challenges in managing concurrent flows using different transport protocols.**

Q3. Subnet Creation and Inter-Subnet Routing in NS3

Design an NS3 simulation that demonstrates the creation and configuration of multiple subnets with inter-subnet routing.

- **Topology:**

    ○ Create at least two subnets, each with its own distinct IP address space.

    ○ Connect these subnets using a router (or a node configured as a gateway via a point-to-point link).

- **Configuration:**

    ○ Set up network interfaces and assign appropriate IP addresses to nodes in each subnet.

    ○ Configure routing between the subnets (using static routes or a dynamic routing protocol available in NS3).

- **Application:**

- Deploy a client-server application where the client is in one subnet and the server is in another.

1. **Capture traffic (using pcap or FlowMonitor) to verify that packets are correctly routed across subnets.**
2. **Analyze and explain the routing behavior and the proper segmentation of the network into subnets.**