CS331:Computer Networks Assignment#3 Submission Date:Before 12-04-2025, 11:59pm

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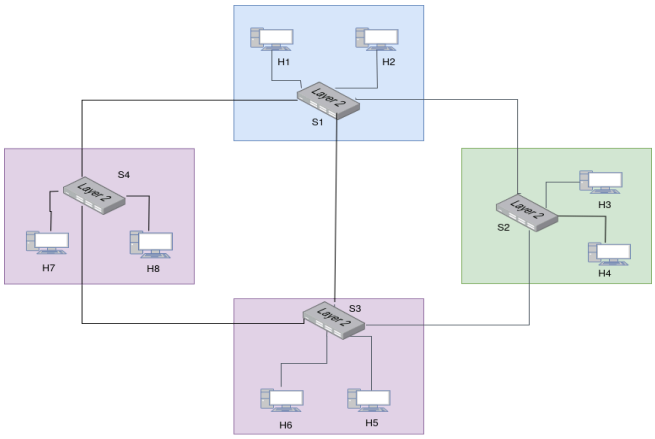
Assignment Guidelines

- **Teamwork: The assignment must be completed in pairs of two students. Only one team member (Member 1) must submit the assignment on behalf of the group**
- **Submit all source code files, and your report (PDF).**
- **Include a README.md file with clear instructions for running your code.**
- **Code must be well-commented and follow good programming practices.**
- **Late submissions will incur penalties according to course policy.**

Q1: Network Loops **(25 Marks)**

Construct the network topology (as shown in the Figure below). Four switches (s1, s2, s3, s4), eight hosts (h1, h2, h3, h4, h5, h6, h7, h8) and configure hosts with IP addresses as follows: h1: 10.0.0.2/24, h2: 10.0.0.3/24, h3: 10.0.0.4/24, h4: 10.0.0.5/24, h5: 10.0.0.6/24, h6: 10.0.0.7/24, h7: 10.0.0.8/24 and h8: 10.0.0.9/24. Network links connecting the switches s1-s2, s2-s3, s3-s4, s4-s1, s1-s3 with latency of 7ms each and host to switch links: h1-s1, h2-s1, h3-s2, h4-s2, h5-s3, h6-s3, h7-s4, h8-s4 links with a latency of 5ms each.



a) Analyse the behavior by running the following ping commands:
   - Ping h1 from h3
   - Ping h7 from h5
   - Ping h2 from h8

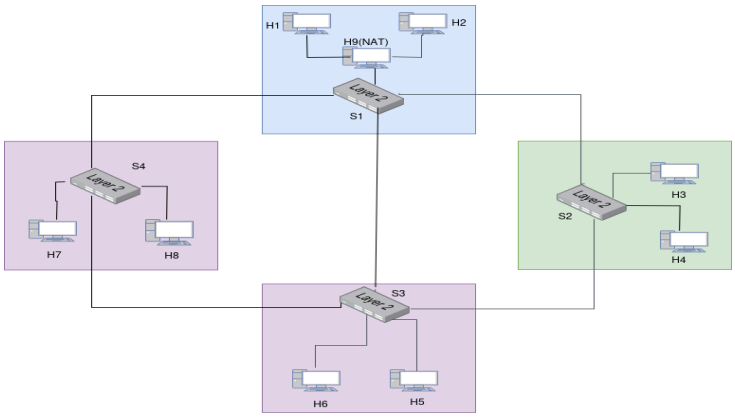
Are the pings successful? If yes, what is the total delay for the pings? If the ping(s) fail(s), analyse and reason what is happening? justify your answer with relevant packet captures.

b) Figure out how to fix the problem without making any changes to the network topology. Confirm the results by running the ping commands given in (a) and show the delay(s).

Note: For proper observation, run each test 3 times with an interval of at least 30 seconds.

Q2:Configure Host-based NAT **(35 Marks)**

Update the topology with the following changes. Add a new host H9 to switch S1, i.e. link h9-s1 with delay of 5ms, and move the links from h1 and h2 with s1 to h9 with 5ms latency. (h1-h9, h2-h9). Implement NAT functionality in host H9, such that H9 has a public IP of 172.16.10.10, serving the private internal IP range of 10.1.1.2 and 10.1.1.3 for hosts h1 and h2 respectively.



a) Test communication to an external host from an internal host:
   i) Ping to h5 from h1
   ii) Ping to h3 from h2
b) Test communication to an internal host from an external host:
   i) Ping to h1 from h8
   ii) Ping to h2 from h6
c) Iperf tests: 3 tests of 120s each.
   i) Run iperf3 server in h1 and iperf3 client in h6.
   ii) Run iperf3 server in h8 and iperf3 client in h2.

Analyze the outcomes of a, b and c. List all the changes necessary to make the connections to succeed. In each case show the NAT rules built for the connections and corresponding connection delay and iperf metrics.

Q3: Network Routing **(40 Marks)**

Solve the programming assignment using the link given below.

This assignment will give you hands-on experience with fundamental routing algorithms in a realistic network emulation environment, allowing you to observe their behaviour and understand their properties. Link: Assignment

Submit a detailed report including the following:

1. README.md, Script(s) used to create and configure the network.
2. All the test results requested for each of the questions.
3. Explanation of any problems encountered and approach taken to resolve them.
4. Relevant screenshots demonstrating successful connection, performance metrics and routing tables.