EE450

Lab3

Session 2

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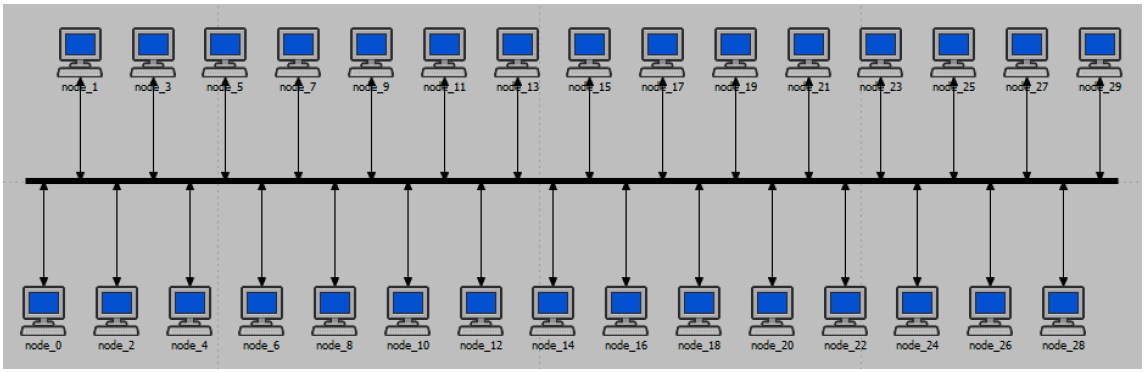
Abstract:

There are two labs that examines the shared & switched Ethernet network, each with different topologies.

The first lab is designed to demonstrate the operation of the Ethernet network. This lab sets up an Ethernet with 30 nodes connected via a coaxial link in a bus topology. It shows the results of throughput of the network that is affected by the network load as well as the size of the packets.

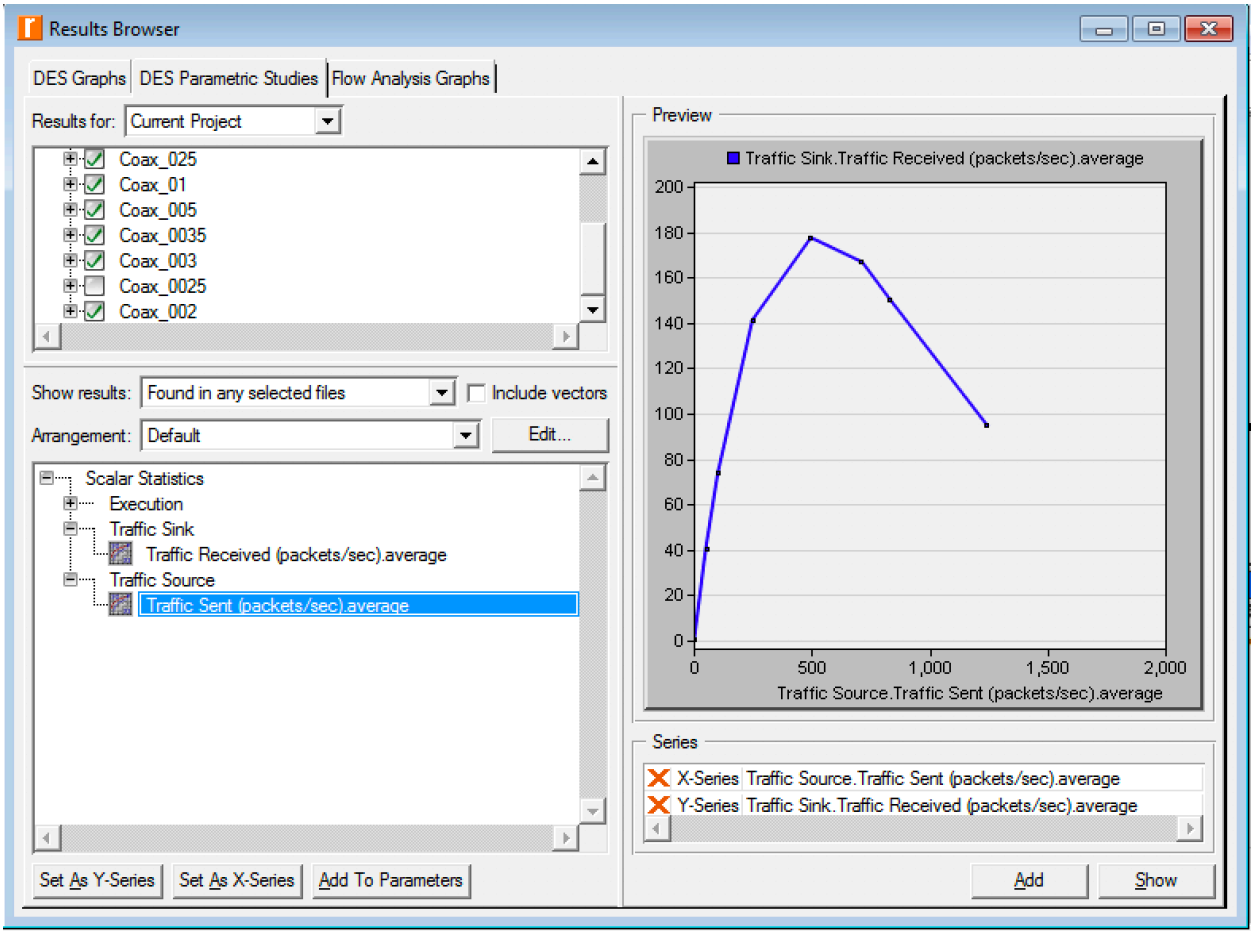
The second lab is designed to demonstrate the operation of a LAN network through a hub and switch. This lab examines the effects that the two switching devices has on the throughput and collision behavior of the network. Each network has 16 nodes.

Part 1

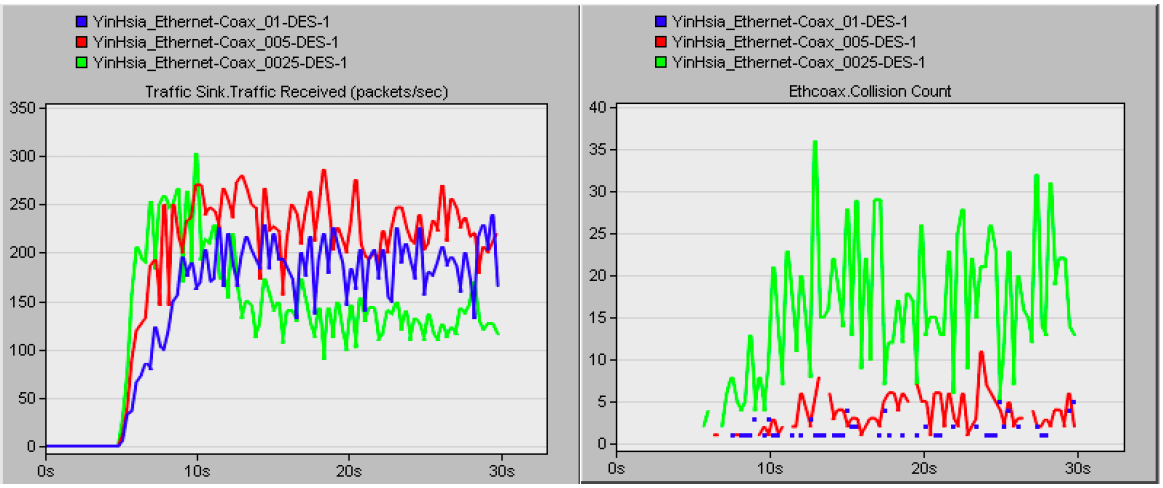


1) Explain the graph we received in the simulation that shows the relationship between the received (throughput) and sent (load) packets. Why does the throughput drop when the load is either very low or very high?

Initially when the load increases, the throughput also increases (more packets sent, more packets received). However, when the load is very high, the throughput drops because there is higher chance of collisions occurred in the shared link.

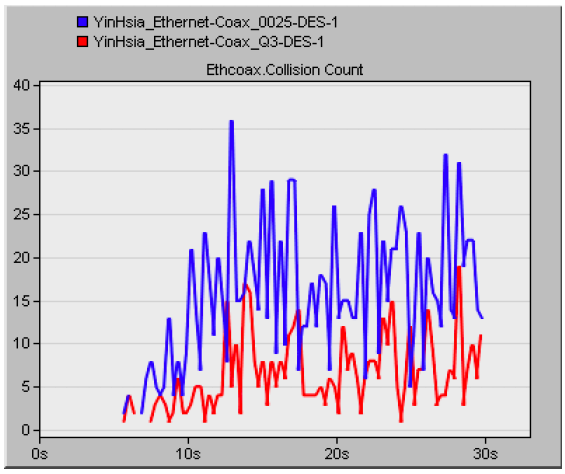


2) Use three duplicates of the simulation scenario: **Coax_01, Coax_005, Coax_0025**
Run the simulation for all three scenarios. Get two graphs: one to compare node 0's collision counts in these three scenarios and the other graph to compare the received traffic from the three scenarios. Explain the graphs and comment on the results



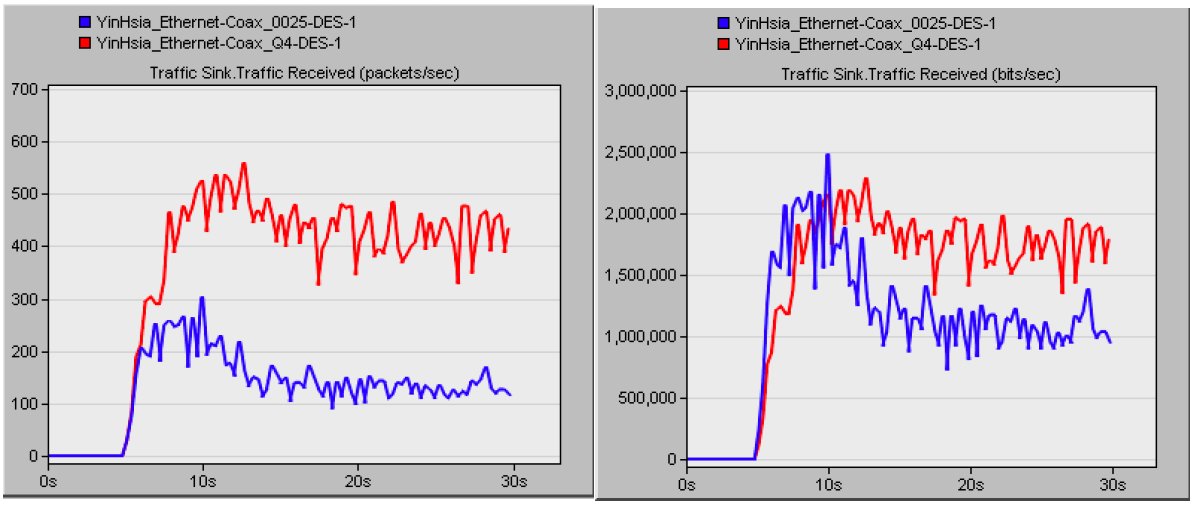
Observed from these two graphs, as the interarrival time decreased, # of collision (node0) increased and the throughput generally decreased as well. This makes sense when we increase interarrival time which means longer waiting time between each packet sent and it would lead to more collisions detected before sending a new message (the collision signal would have enough time to propagate back to the node). By decreasing the interarrival time we would achieve the opposite effect.

3) Create a duplicate of the **Coax_0025** scenario and name the new scenario **Coax_Q3**. In the new scenario, remove the odd- numbered nodes. Create a graph that compares node 0's collision counts in scenarios **Coax_0025** and **Coax_Q3**. Explain the graph and comment on the results.



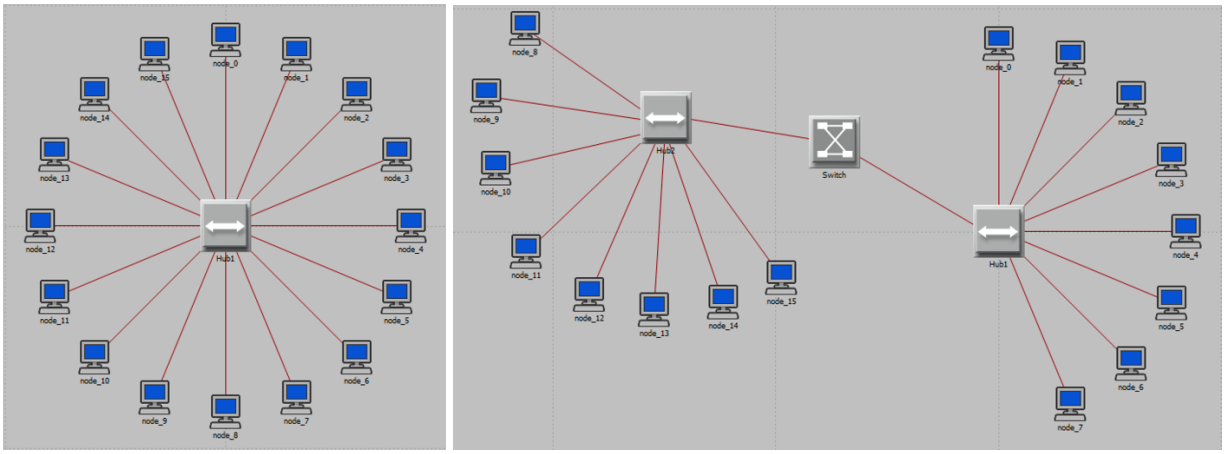
In Coax_Q3 network, the number of nodes is exactly half of that in Coax_0025 network. Since there are less nodes sharing the bus which means less messages are sent over the link and it would decrease the number of collisions.

4) To study the effect of the packet size on the throughput of the created Ethernet network, create a duplicate of the **Coax_0025** scenario and name the new scenario **Coax_Q4**. In the new scenario use a packet size of 512 bytes (for all nodes). Create a graph that compares the throughput as packets/sec and another graph that compares the throughput as bits/sec in **Coax_0025** and **Coax_Q4** scenarios. Explain the graphs and comment on the results.



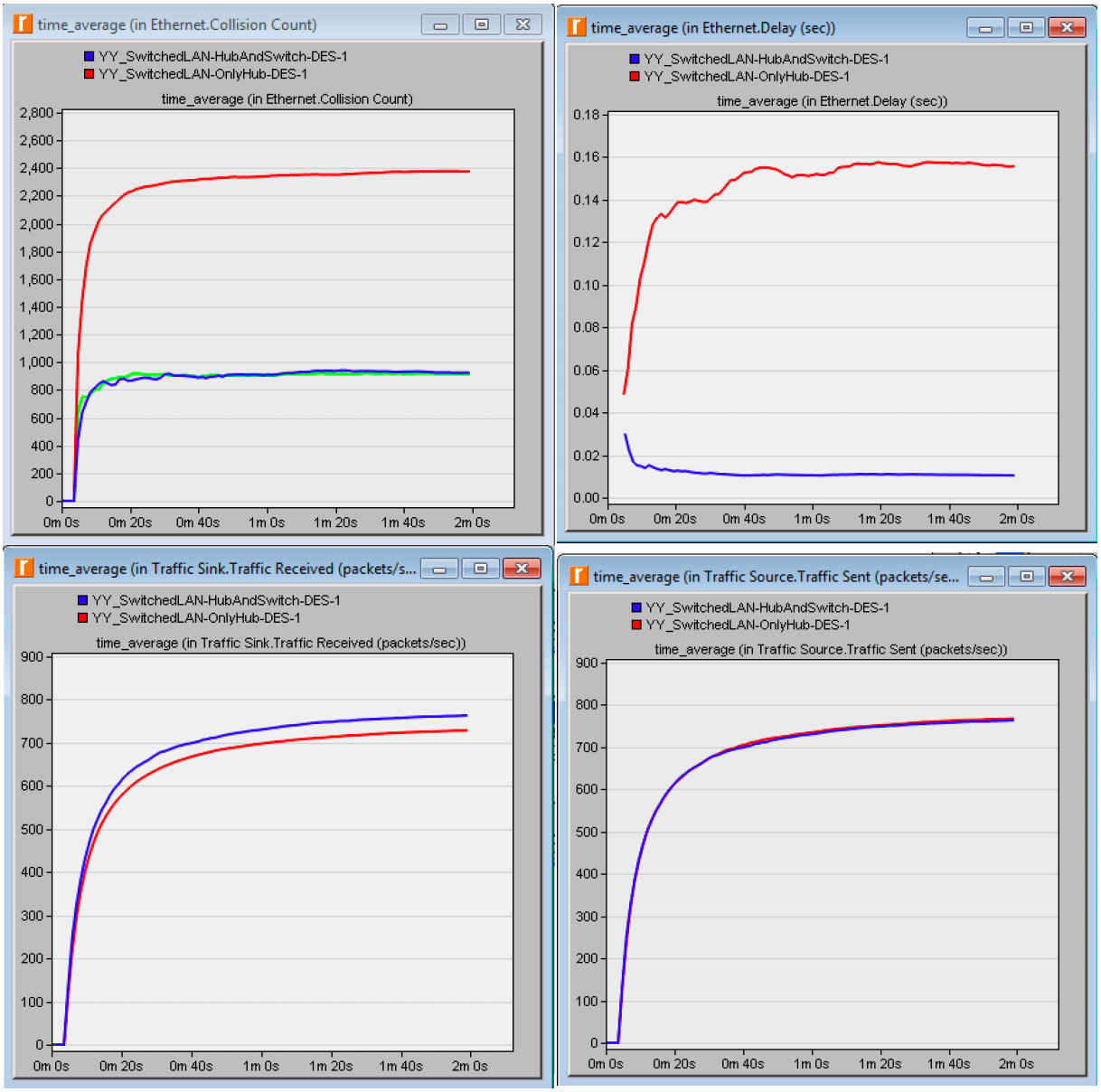
The throughput in Coax_Q4 is greater than that of in Coax_0025 in terms of packets per second. A larger packet size means it will take longer to send the packet. The chance that a collision will occur becomes more likely since the packet size is large therefore reducing the overall throughput.

Part 2



1) Explain why adding a switch makes the network perform better in terms of throughput and delay.

The switch forwards the packet directly to the destination so that it avoids a part of collision and it also isolates collision domain which reduces overall delay and increases the throughput (less collision, less retransmitted packet).



2) We analyzed the collision counts of the hubs. Can you analyze the collision count of the "Switch"? Explain your answer.

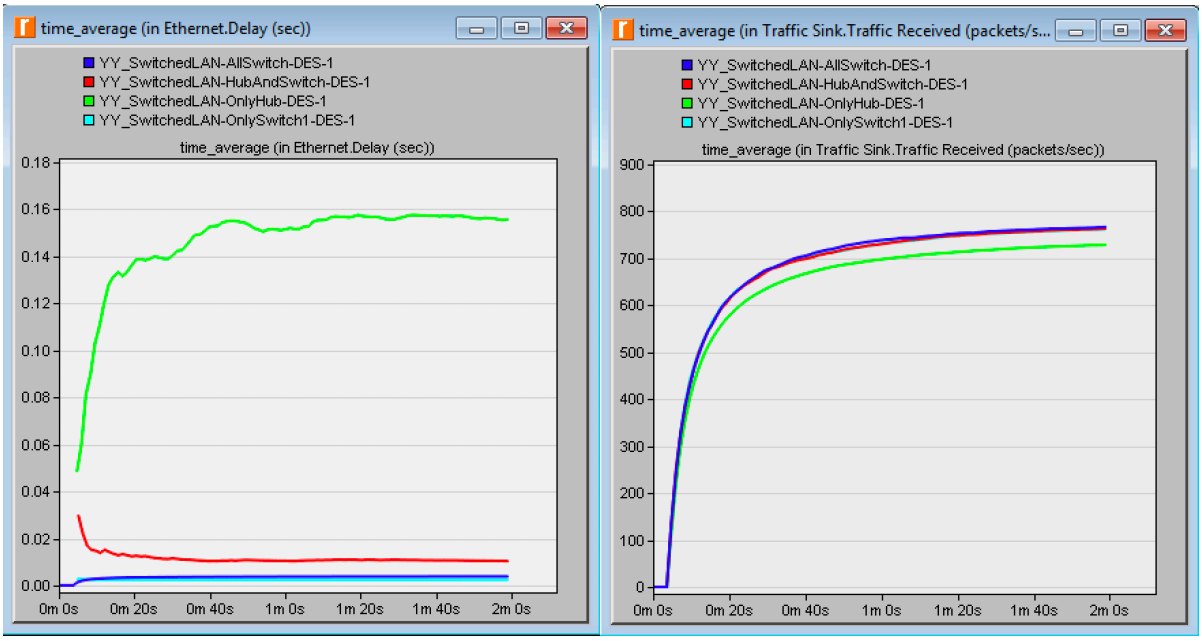
The collision count of the switch cannot be analyzed, since there is no collision between the switch and the network it attaches to.

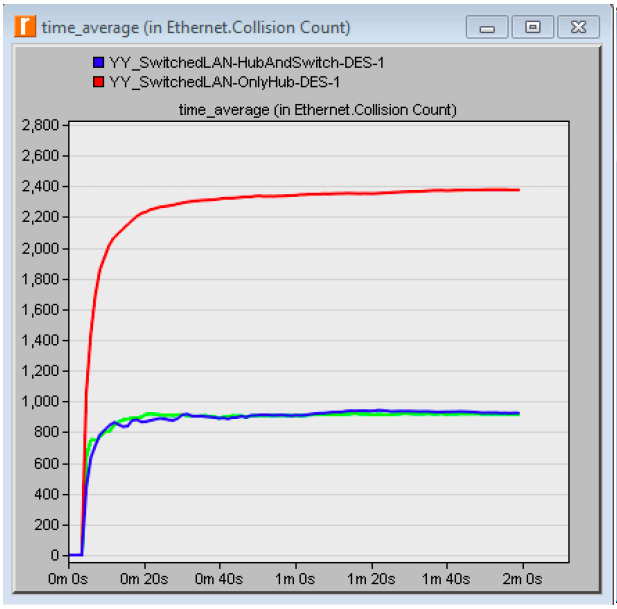
3) Create two new scenarios. The first one is the same as the **OnlyHub** scenario but replace the hub with a switch. The second new scenario is the same as the **HubAndSwitch** scenario but replace both hubs with two switches, remove the old switch, and connect the two switches you just added together with a 10BaseT link. Compare the performance of the four scenarios in terms of delay, throughput, and collision count. Analyze the results. Note: To replace a hub with a switch, right-click on the hub and assign **ethernet16_switch** to its **model** attribute.

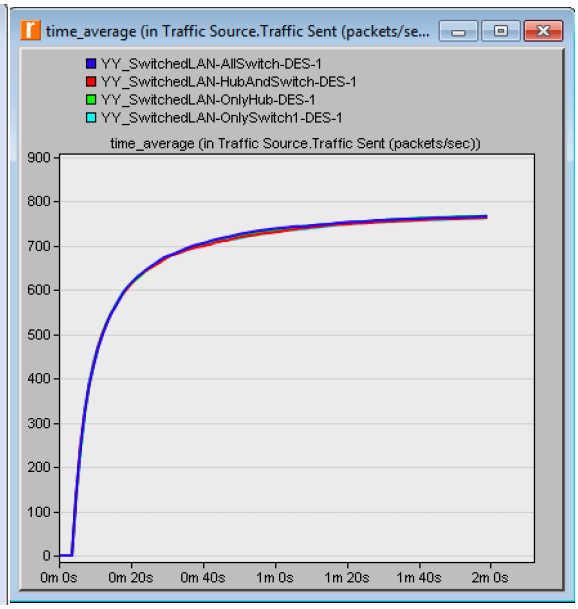
1. Traffic sent (packet/sec):
The traffic sent in all four cases are almost identical.

2. Collision count:
Since in a purely switch network, there is no collision, two new scenarios do not present any collision. The collision count in the first two cases has already been discussed in question 1.

3. Throughput & delay:
The throughput in purely switched networks are almost identical with the network with one switch and two hubs. The two purely switched networks reach slightly higher throughput than that of in one switch and two hubs network. Although there exists collision in the latter network, the delay among three networks are close which makes up the throughput performance. However, all the three networks outperform a purely hub network, as collision happens quite often and delay is relatively high in a purely hub network compare to the other networks.







Conclusion:

In this lab, I learn how switched LANs and Ethernet works. From lab 1, the throughput can be affected by the load, packet size, interarrival time and collision counts. Basically, as the load increases, the throughput increases as well. However, the throughput drops dramatically as more collision occurred. From lab 2, the throughput and collision of packets in a switched network are affected by the configuration of the network and the types of switching devices that are used. In a purely hub network, collision happens quite often, thus, its throughput is the worst among all examined networks. By adding a switch, the result shows that it makes the network perform better because it has less collision.