Lab Exercise 6

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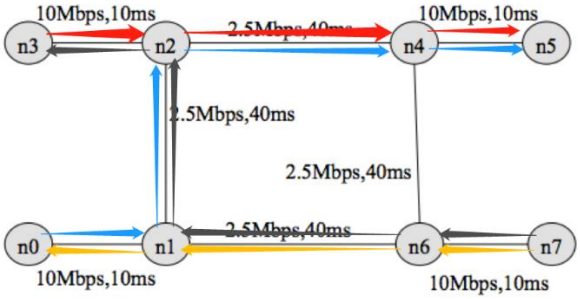
Exercise 1

Here are the routes of four flows: (**Blue Arrow** represents TCP1 (n0->n5), **Red Arrow** represents TCP2 (n3->n5), **Yellow Arrow** represents n7->n0, **Black Arrow** represents n7->n3)



Q1.

During the period of 6 sec to 8sec, a new flow(n7->n3) is created (shown in **Black Arrow**). The new flow has the same route on n1->n2 with TCP1, so the RTT of TCP becomes longer and throughput becomes lower. Because of this, the throughput of TCP2 becomes higher.

Q2.

Between 0.5sec and 2sec, only the flow TCP1 exists. Therefore, the fluctuation is caused by slow start and congestion control.

Q3.

Because the max bandwidth is 1.5Mbps. It's found by TCP1. Between 0.5sec and 2sec, only flow TCP1 exists, so it detected the max bandwidth using slow start.

Exercise 2

Q1.

- Both **2000 bytes** and **3500 bytes** cause fragmentation. Because the default MTU of Ethernet is 1500 bytes, any size greater than it will be fragmented.
- The **first router** the data passed fragmented the original datagram.
- **Two** fragments have been created when data size is specified as 2000.

Q2.

- **Yes,** the reply also gets fragmented.
- Because the size of reply is also greater than the size of default MTU (1500 bytes).

Q3.

No.	ID	Length(bytes)	Flag	Offset
39	0x7a7b	1514	0x01	0
40	0x7a7b	1514	0x01	1480
41	0x7a7b	582	0x00	2960

Q4.

- **Not used.**
- Because when the destination receives the data, it will reassemble the data into one packet.

Q5.

If one fragment is lost, the sender will find out, and then resend the whole packet.

Exercise 3

Q1.

- Both **node 0** and **node 2** send packets to node5 respectively.
- Node 0 follows the route **0->1->4->5**, and node 2 follow the route **2->3->5**. These two routes **never change** over time.

Q2.

- At time 1.0, the link between node 1 and node 4 starts to be down. At time 1.2, the link between node 1 and node 4 is up.
- **The routes are not changed**, but the transmission between node 0 and node 5 are **cut off** at the link n1<->n4.

Q3.

- **Yes.**
- At time 1.0, the link between node 1 and node 4 is down, and the transmission between node 0 and node 5 changes its route. At time 1.2, the link between node 1 and node 4 is up, and the transmission between node 0 and node 5 changes its route back.

Q4.

- The route between node 0 and node 5 is change to 0->1->2->3->5.
- Because the line 87 change the cost of the link between node 1 and node 4 to 3, so the total cost of the previous route become 5, then the flow chooses a new route (0->1->2->3->5) with lower cost.

Q5.

The route between node 2 and node 5 becomes two routes (2->3->5 and 2->1->4->5), and the packets come from node 2 changes it routes every two transmissions. That's because line 29 sets multipath between node 2 and node 5. And line 89 and 90, reset the cost of link n1<->n4 to 2, and the cost of link n3<->n5 to 3. In this way, the cost of route 2->1->4->5 becomes 4, which is same as the cost of 2->3->5. So there are two routes between node 2 and node 5.