Exercises 1: Consider, the NASA satellite station control room on Earth and a Rover on Moon is connected by a 100 Mbps point-to-point wireless link. The distance between from Earth to Moon (when they are closest together) is approximately 384 x 10^3 km, and data travels over the link at the speed of light is 3×10^8 meter/sec.

- Question 1: How long does it take for a packet to travel from Rover to NASA satellite station control room? Determine the answer in milliseconds.
- Question 2: Calculate the product of RTT and bandwidth for the link. Find the answer in Megabits/sec and Megabytes/sec.
- Question 3: A camera on the rover takes pictures of its surroundings and sends these to Earth. How quickly after a picture is taken on rover, can it reach NASA satellite station control room on Earth (ignore the processing delay)? Assume that each image is 25 MB in size. Find the answer in seconds.

Exercises 2: Consider a router A is transmitting packets, each of length L bits, over a single link with transmission rate R Mbps to another router B at the other end of the link. Suppose that the packet length is L= 1 Kbit, and that the link transmission rate along the link to router on the right is R = 50 Mbps.

What is the transmission delay?

Exercises 3:

a) Consider the queuing delay in a router buffer, Assume a constant transmission rate of R = 100000 bps, a constant packet-length L = 1000 bits, and a is the average rate of packets/second. Traffic intensity I = La/R, and the queuing delay is calculated as I(L/R) (1 - I) for I < 1.

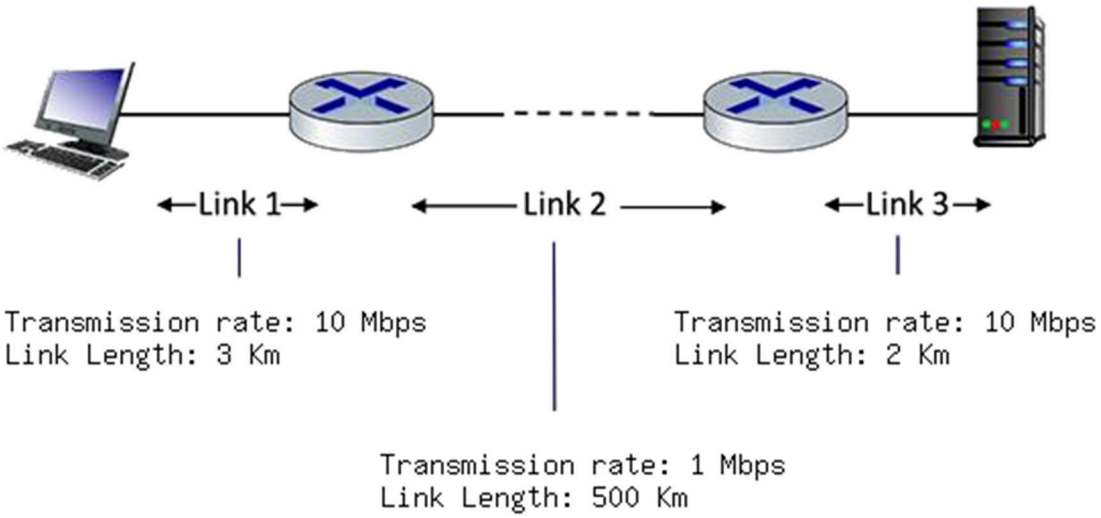
- Question 1: In practice, does the queuing delay tend to vary a lot? Answer with Yes or No
- Question 2. Assuming that a = 34, what is the queuing delay? Give your answer in milliseconds (ms)
- Question 3. Assuming that a = 60, what is the queuing delay? Give your answer in milliseconds (ms)

b) Consider the queuing delay in a router buffer, Assume a constant transmission rate of R = 100000 bps, a constant packet-length L = 1000 bits, and a is the average rate of packets/second. Traffic intensity I = La/R, and the queuing delay is calculated as I(L/R) (1 - I) for I < 1.

- Question 4. Assuming the router's buffer is infinite, the queuing delay is 1.1003 ms, and 1260 packets arrive. How many packets will be in the buffer 1 second later?
- Question 5. If the buffer has a maximum size of 734 packets, how many of the 811 packets would be dropped upon arrival from the previous question?

Exercises 4

- Consider the figure below, with three links, each with the specified transmission rate and link length
- Assume the length of a packet is 12000 bits. The speed of light propagation delay on each link is 3x10^8 m/sec.
- Round your answer to two decimals after leading zeros



Question 1: What is the transmission delay of link 1?

Question 2: What is the propagation delay of link 1?

Question 3: What is the total delay of link 1?

Question 4: What is the transmission delay of link 2?

Question 5: What is the propagation delay of link 2?

Question 6: What is the total delay of link 2?

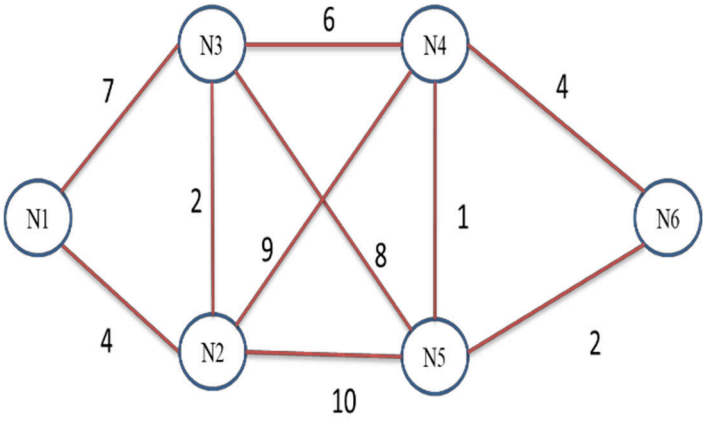
Question 7: What is the transmission delay of link 3?

Question 8: What is the propagation delay of link 3?

Question 9: What is the total delay of link 3?

Question 10: What is the total delay?

Exercises 5: Apply distance vector routing algorithm on given network. Update and write the corresponding forwarding table for router N1, N4, N5 and N6 after end of the 2nd Pass.



Exercises 6: Consider the following network where EIGRP protocol is used for routing. Find the Successors and Feasible Successor route for Router 1 to reach the IP address 192.168.10.10/24.