EECS 489 - FA 21

Discussion 2

Assignment-1

Due date: **09/22 2021, 11:59 PM**

Please make sure to:

- register your GitHub username
- join our GitHub organization (accept the invitation)
- use your private p1-uniqname repo to upload your submission

Hosted in GitHub under https://github.com/eecs489

The autograder will be available soon.

Performance Metrics - Delay

- Link properties
  - Transmission delay
  - Propagation delay
- Traffic mix and switch internals
  - Queuing delay
  - Processing delay (negligible)

Performance Metrics - Throughput

- Throughput = Data transferred / Transfer time
- Transfer time = transmission delay + propagation delay

Performance Metrics - Q1

Suppose a 100-Mbps point-to-point link is being set up between Earth and a new lunar colony.
The distance from the moon to Earth is approximately 385,000 km, and data travels over the link at the speed of light = 3*10^8 m/s.

(a) Calculate the minimum RTT for the link.

propagation delay = 385000 km / (3 * 10^5 km/s) = 1.28333s
RTT = 2 * propagation delay = 2 * 1.28333 = 2.56666s

Performance Metrics - Q1

Suppose a 100-Mbps point-to-point link is being set up between Earth and a new lunar colony.
The distance from the moon to Earth is approximately 385,000 km, and data travels over the link at the speed of light = 3*10^8 m/s.

(b) Suppose Mission Control on Earth wishes to download a 25MB (1MB = 10^6B) image from a camera on the lunar base. What is the minimum amount of time that will elapse between when the request for the data goes out and the transfer is finished? Throughput?

transmission delay = 25MB / 100Mbps = 25 * 8 / 100 = 2s
delay = RTT + transmission delay = 2.5666 + 2 = 4.5666s
throughput = 25MB * 8 / (2s + 1.28333s) = 60.9 Mbps

Performance Metrics - Q1

Suppose a 100-Mbps point-to-point link is being set up between Earth and a new lunar colony.
The distance from the moon to Earth is approximately 385,000 km, and data travels over the link at the speed of light = 3*10^8 m/s.

(c) The maximum number of flying bits on the link?

bits = propagation delay * bandwidth
= 1.28333s * 100Mbps = 1.28333 * 10^8

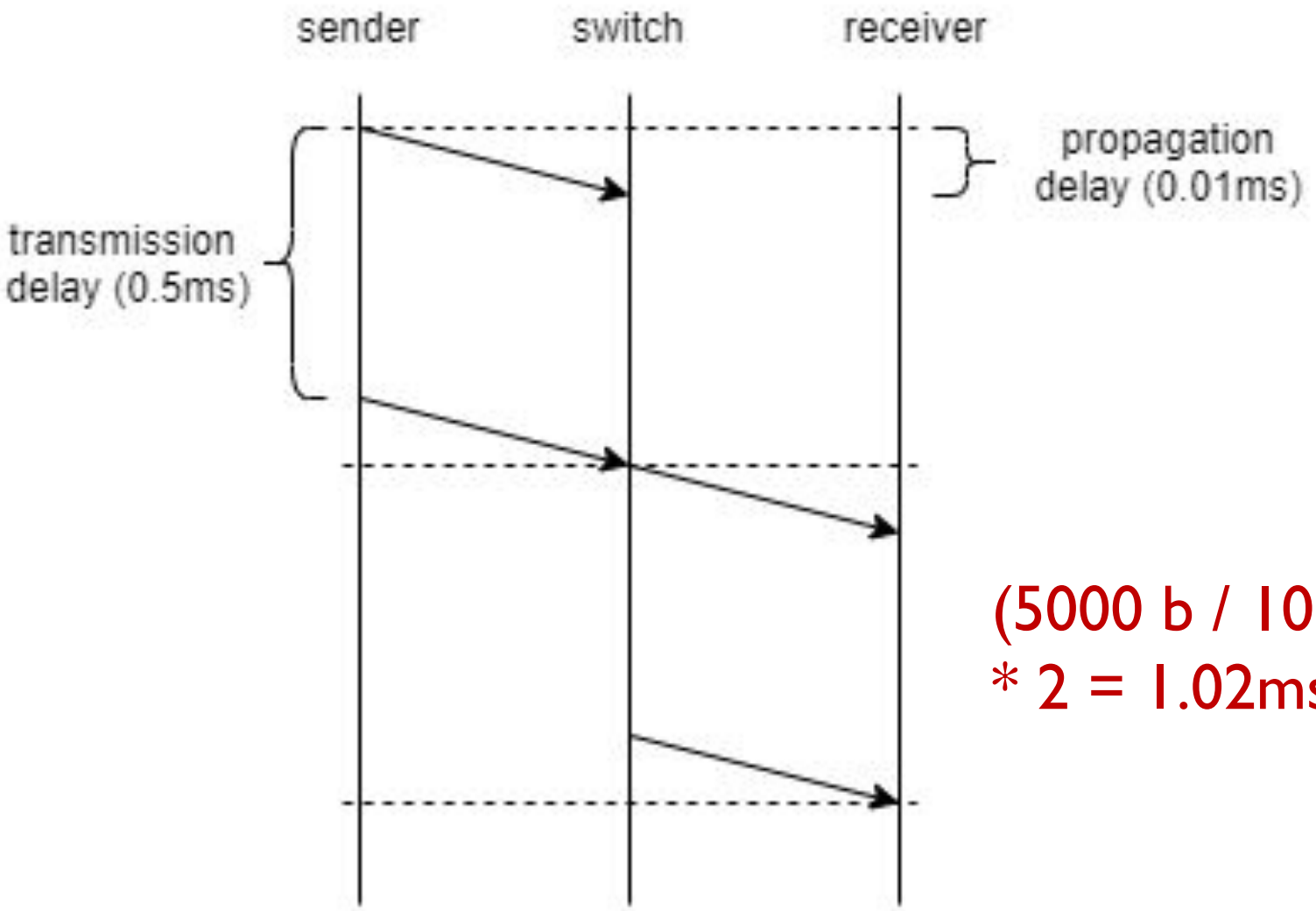
Performance Metrics - Q2

Calculate the latency (from first bit sent to last bit received) for the following:

(a) A 10-Mbps link with a single store-and-forward switch in the path, and a packet size of 5,000 bits. Assume that each section of the link introduces a propagation delay of 10 microseconds, and that the switch begins retransmitting immediately after it has finished receiving the packet.

(5000 b / 10Mbps + 10us) * 2 = 1.02ms

Performance Metrics - Q2



(5000 b / 10Mbps + 10us)
* 2 = 1.02ms

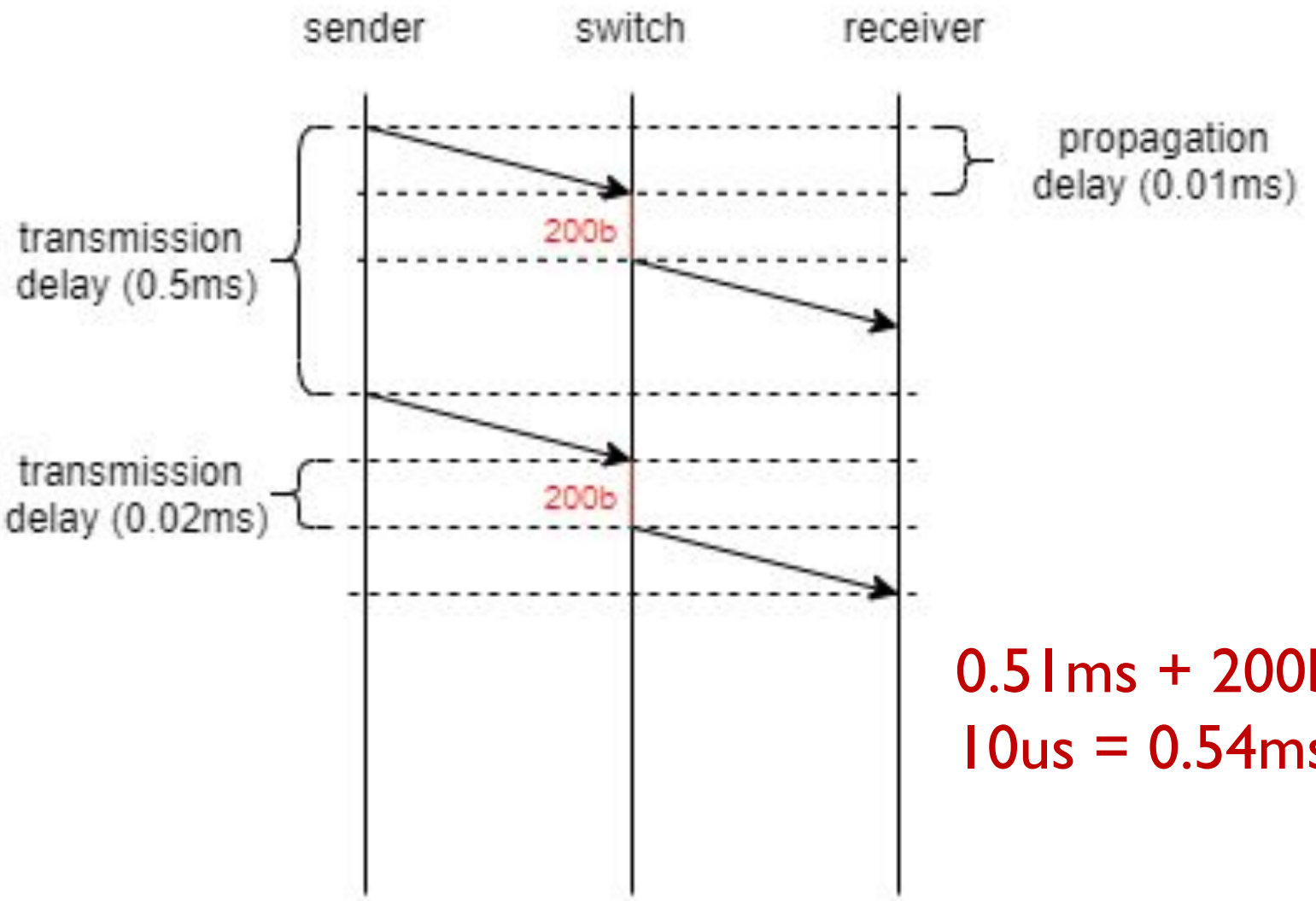
Performance Metrics - Q2

Calculate the latency (from first bit sent to last bit received) for the following:

(b) A 10-Mbps link with a single cut-off switch in the path, and a packet size of 5,000 bits. Assume that each section of the link introduces a propagation delay of 10 microseconds, and that the switch begins retransmitting immediately after the first 200 bits have been received.

0.51ms + 200b / 10Mbps + 10us = 0.54ms

Performance Metrics - Q2



0.51ms + 200b / 10Mbps + 10us = 0.54ms